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The Registration Problem

FROM its inception twelve years ago the National Register of Electrical Installation Contractors has laboured under several disabilities. In the first place, it is a purely voluntary scheme, and on this account depends for its success on the support of a majority of those in the contracting industry; of engineers, architects and builders responsible for the placing of installation work; and, in the last resort, of the public.

To secure this support at least two things are necessary: A corporate spirit which, above all, will maintain, a high standard of work; and publicity.

The first requisite is lacking. The bulk of those who are registered are content to pay a small fee to secure a certificate. They have made few attempts to get together in their localities to make an impression either upon those who have orders to place or upon a wider public. The Registration Board itself has no funds for the extensive propaganda necessary to make the public aware of the Register and what it stands for, and, as a consequence, practically nobody outside the electrical industry, and comparatively few within it, have any knowledge of the scheme.

Moreover, there is another, and much better known, Richmond in the field—the Electrical Contractors' Association. This body, one of the oldest in the electrical industry, looks after both the contracting and trading interests of its members. In effect, so far as the contracting side is concerned, it serves the purpose of the Register, but insists on a higher standard of workmanship, equipment and financial stability. These higher standards have closed the Association's doors to hosts of contractors, many of them small men of honesty and ability. The E.C.A., recognising this fact, has given wholehearted support to the Register from the beginning. Its recognition is not purely altruistic, of course. The Association realised that if these smaller sheep could be separated from the goats the latter might possibly be forced to raise their standards or be forced out of the business altogether. In this way the competition suffered by E.C.A. members from cheap and nasty work would be eliminated, to their benefit and for the public good.

The extent of the support afforded to the Register by the E.C.A. may be gauged from the fact that over 800 of its 1,400 or 1,500 members are registered. The total number on the Register is 1,740. Thus, it will be seen, the two organisations together represent about 2,400 contractors. But it has been estimated that there are several times this number of people in Great Britain who are doing installation work; what of the other thousands?

Some of the men already on the Register are not beyond reproach, as the inspections instituted about two years ago have disclosed. The employment of ill-paid and juvenile labour is one major trouble which the Executive Committee now has under serious consideration. The principal matter engaging the attention of the Committee, however, is probably the relationship between the Register and the E.C.A. This point, among others, is considered in an article by Mr. H. R. Taunton in this issue, in which he suggests some very drastic remedies.

We cannot but feel that Mr. Taunton has reason on his side when he questions the justification for the duplication which exists at present, but the elimination of this by the withdrawal of E.C.A. members would leave the Register without a backbone. The suggested remedy—the absorption of the Register by the E.C.A.—would certainly end this duplication, but so far as we can see it would not bring much nearer the ideal at which both organisations aim—the raising of the standard of installation work and the elimination of the incapable and dangerous "jerry" contractor, which were really the aspirations or objectives which originally brought the registration movement into being.

Here is a pretty problem to which compulsory registration is probably the only solution, yet one that few regard as likely to be realised.

Sir Felix Pole and Brazil

Several points of special interest emerged in the course of the speech of Sir Felix Pole at the meeting of the group of well-known manufacturing concerns operating as Associated Electrical Industries, Ltd. The story of the enormous business done included an appropriate reference to the visits paid to overseas markets, and special mention was made of the chairman's mission to Brazil, accompanied by Mr. Turner, the M.V. Sales Director. Mainly, this visit was undertaken in connection with a particular contract, but it afforded an opportunity to make contact with important customers in an "immense country" which was described as one whose potentialities are not sufficiently appreciated here. If there is failure to understand the value of the Brazilian market, it is not due to want of emphasis in these pages—probably Sir Felix was referring to potentialities in general, rather than electrical in particular. In this connection it is timely to refer to the further article on Argentina, by Mr. H. C. Siddeley, which appears in this issue of the Electrical Review. It is unthinkable that anybody can have sat through half an hour's chat with the author, as we have done, without catching something of the enthusiasm which oozes from his every pore as he speaks of Argentina, Brazil and other parts of South America as a field for British electrical and allied trade.

Price and Depreciation

Price questions, depreciation, and American stock-holding were among the matters touched in other parts of the Associated Electrical speech. The price question in relation to heavy electrical apparatus is naturally coming much to the fore again. Figures are stated to be still too low, bearing in mind the advancing price of raw materials as well as the wage increase commitments entered into by manufacturers in 1935. As to depreciation, nearly £350,000 was set apart for this purpose last year by the companies in the group. Sir Felix's reference to the wisdom of this policy will not be questioned, for engineering experience has repeatedly shown that substantial depreciation of plant must be allowed for from year to year if we are to conduct industry on sound lines. We not only have to make provision for the changes that are sure to come, but for others which we have learnt too painfully cannot be foreseen; and when trade is satisfactory, the exercise of discretion in this respect is right and proper practice. Concerning American holdings in the associated companies, the sale of a large American block during the year has resulted in a substantial majority of the stock being now held in this country, and there is thus an increase in the number of holders—some 3,000 more people being directly interested in the welfare of the A.E.I. In the course of his speech at the English Electric Co.'s meeting on Monday, Mr. G. H. Nelson also referred to prices, wages and materials and to the impressive advance in trade both Home and overseas.

The Bradford Inquiry Ends

The Electricity Commissioners' inquiry into the failure of supply at Bradford was concluded on April 2nd, and Mr. H. Nimmo's report will presumably be published within the next few weeks. Whatever the outcome, most of us will agree with the Town Clerk of Bradford that the holding of a public inquiry was the best thing to do. Apart from several pointers to future practice that may be deduced from the evidence, an opportunity has been provided to correct inaccurate statements and to elicit favourable opinions from important industrial consumers regarding public supply; many of these have obtained an uninterrupted supply from the Corporation mains for over ten years. The inquiry seems to have allayed anxiety among smaller consumers also, as, according to a Yorkshire daily, the number of applications for supply has been greater than usual since February 24th. Especially satisfactory is the information that in one case where a prolonged cessation of supply to a colliery would have been really serious, electricity was made available on the morning following the breakdown.

Circuit-breakers in Service

Recognition of the influence of the rate of rise of restriking voltage on the short-circuit performance of circuit-breakers is due largely to investigations carried out at switchgear testing stations. Our technique being necessarily empirical, investigations that relate the conditions imposed in a laboratory with those obtaining in practice should be of considerable utility. The series of tests now being carried out on the high-voltage system of the North-Eastern Electric Supply Co., Ltd., by Messrs. A. Reyrolle & Co., with the assistance of the Electrical Research Association, is really supplementary to the work at the Hebburn testing station. These tests are designed to enable type tests at such stations to be standardised under extreme conditions and the probable performance of existing circuit-breakers at various points on a large network to be predicted. The test data so far obtained show that co-operation on similar lines between the Electrical Research Association, supply undertakings and manufacturers is likely to be fruitful in results of practical value.

A Discussion on Tariffs

If the discussion that followed the I.E.E. papers of Professor Miles Walker and Mr. B. Handley was less controversial and lively than earlier debates which we remember on the same topic, that is probably no bad sign. There seemed to be a general appreciation of the fundamental principle, referred to by Mr. Handley, that people do not want electricity as such, but certain services performed in the most convenient and economical way. One heard nothing of the old academic concepts of "scientific" and "equitable" tariffs, but much about ways of inducing householders to use more electricity and to feel that they were being reasonably treated. Perhaps, however, there was evident a tendency to measure progress too much in terms of kWh consumed without weighting it by variety of applications. The merits of the two-part tariff with the primary charge based either on the size of the house, the standard, or on the rateable value, which has many adherents, there was none to dispute, and a general "point five" secondary charge seemed to be the aim of everybody. One defender only of a multiplicity of tariffs was to be found, but his success may be only further evidence that, important as sound tariffs are, it is the energy and judgment behind them that count most.

Rectifier Design

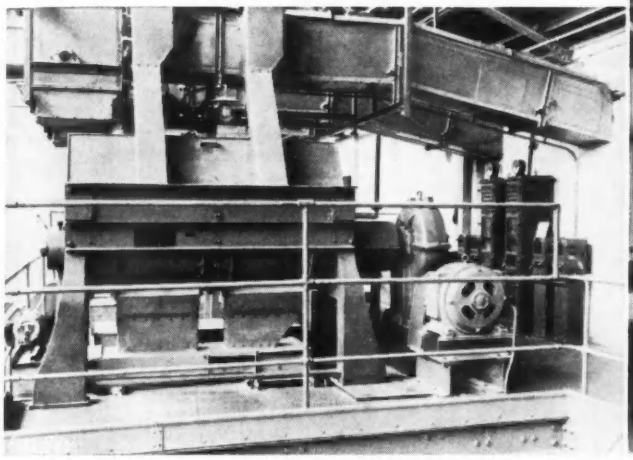
Much thought is being put into the drawing up of specifications for rectifier plant just now. The British Standards Institution has one in preparation, which will presumably be read in conjunction with a revised B.S.S. No. 171 for power transformers. The American Institute of Electrical Engineers has recently issued a draft of a further standard (No. 6) for metal-tank rectifiers, while committees in several European countries are making submissions in regard to a standard specification to the International Electro-technical Commission, which is itself putting forward recommendations for international regulations. In Germany draft rules have been published, the salient particulars of which are given in this issue. They take account of associated transformers, since the requirements for these differ appreciably from the existing V.D.E. standard. They do not lay down the usual limits of operating temperature, neither do they cover invertors and frequency convertors on the ground that these are not sufficiently developed. The idea, as in the American specification, seems to be to avoid the formulation at this stage of rigid standards that might hamper development.

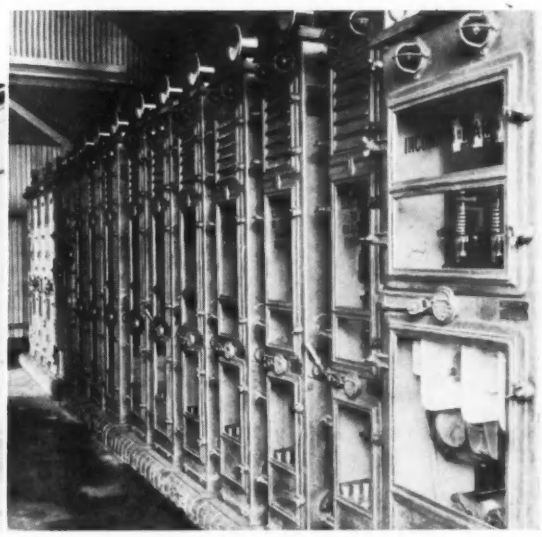
Centralised Control of Works Equipment

The electrical system at a large soap factory

SOAP-MAKING at the Port Sunlight works of Messrs. Lever Bros., Ltd., involves the boiling of vegetable oils and other ingredients in large steam-heated vats, and then, according to the type of the product (household or toilet soap, flakes or powder), drawing off the liquid soap for cooling into large blocks for subsequent cutting up into bars, or cooling it in drying rolls for further mixing and milling operations, again according to the class of product and the consequent degree of refinement required. In addition, there are extruding, labelling, wrapping and packing processes.

All these operations demand electrical service in one form or another, from the driving of pumps for the transmission of liquid soap to the heating of the glue-pots for container sealing, and from 70-h.p. mill drives to fractional-horse-power drives for small conveyors. Further, the production of oils by milling from various kinds of nuts, unloading raw materials and loading the finished products at the company's Bromborough dock all make extensive demands on the electricity supply.



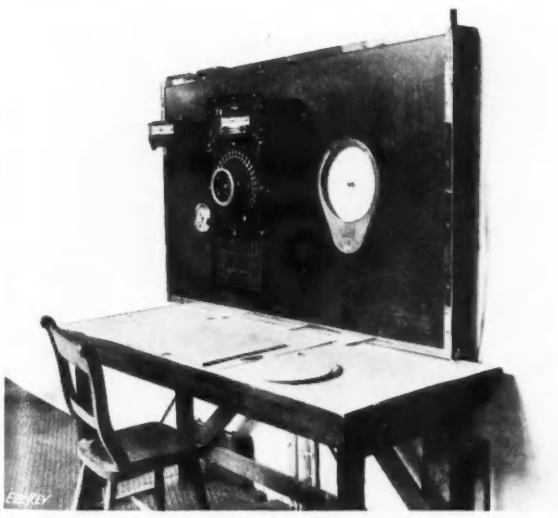


Left: Nine-point centrally controlled conveyor and mixing system feeding the toilet-soap department. Right: Starting panels for the dock conveyor

Individual Drives

There are many individual drives for the works plant, in some cases with incorporated motors and multi-motor drives working in operation sequence. Five motors are employed for each of a certain class of packing and weighing machines. A one-h.p. motor surmounting the machine head drives the carton-forming section *via* belt and jockey pulley; a two-h.p. geared unit with chain transmission serves the weighing section; a half-h.p. motor drives the shaker; and two one-h.p. motors drive, respectively, the bottom sealer and the conveyor. All these squirrel-cage, three-phase, 400-V Mawdsley motors are switched direct on the line by contactor starting gear and are remote push-button controlled. All the push-buttons are mounted on a common inclined panel, and additional buttons provide for collective operation. There is also an on-circuit indicating lamp for each set of buttons. The weighing equipment is supplied by a Westinghouse metal rectifier with a d.c. capacity of 0.75 A at 200/240 V.

These packing machines are fed *via* band conveyors from mills which roll the soap flakes to the required thickness, each mill being driven by an outside-ventilated "Maxtorque" s.c. three-phase, 400-V motor supplied by the English Electric Co., Ltd., and for each motor there are an auto-transformer starter and an oil-circuit breaker of the same make. The circuit-breaker handle is interlocked with the handle of the isolator mounted above. On another conveyor system we saw cases containing filled packets of "Lux," the cases themselves individually operating the last section of the conveyor by lifting up a switch-operating arm on entry and releasing the arm again after travelling the full length, thus starting and stopping the motor.



Control panel for the 48-point electrical distant thermometer system; on the right is the feeder time-recording instrument

It is the centralised system of motor control such as we have depicted which is the feature of the modern electrical installation in the works. Centralised control is being aimed at wherever production permits on the score of increased efficiency in that the operator can give more time and attention to the production operations. It also presents a measure of increased safety, especially in view of the rigid interlocking of the control gear that is an essential part of the scheme.

Continuous Sequence of Operations

It is, however, in connection with the production of the finer grades of soap, which require a continuous sequence of operations, that centralised control is more highly developed in the works proper. In one case the sequence of electrically controlled operations on one machine, hopper fed *via* an elevator from a mixing machine, are hopper feed, elevator drive, mill drive, elevator drive and plodder motor (Lancashire Dynamo & Crypto, Ltd.). The motor-starting panels are placed conveniently about the machine, but all the push-button controls are on one pedestal board. From the plodder the soap is extruded in a continuous bar which is first cut into lengths and then into tablets that are subsequently cooled, stamped, wrapped and packed.

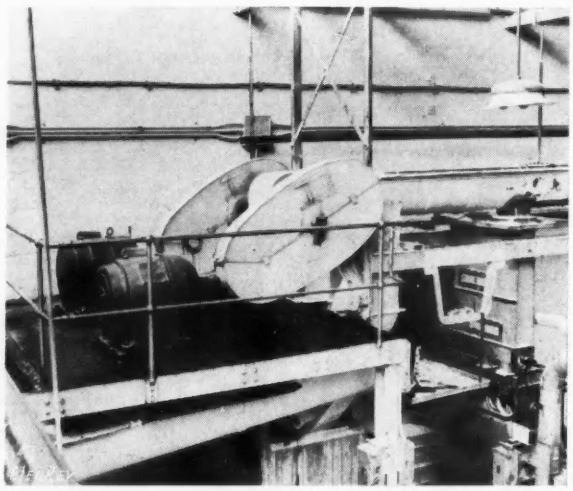
Squirrel-cage motors are employed almost exclusively for these drives, on account of constant speed and low maintenance cost. In place of direct contactor starting equipment for the smaller machines with single drives and without continuous sequence operations and remote control, auto-transformer starters and oil switches are employed. Another centralised control scheme in the toilet-soap works is that in which each of a number of nine-point control panels serves a cross-conveyor system and mixers between the soap solidifying and drying plant and the toilet-soap department proper.

The nine motors in the scheme vary in size from ¼ h.p. for the works feeding conveyor drive to 15-h.p. for each of the mixer drives. The central panel, in addition to the start and stop push-buttons and indicating lamps and the motor circuits, also carries an operating push-button for the trip-coil release

on the weighing plant. As with the other remotely controlled schemes, the motors of up to 5 h.p. are directly started through the contactors, while the larger motors employ star-delta or auto-transformer starters incorporated in the starting panels.

The nature of the driven equipment, that is, whether it will permit light load at starting or not, is often the deciding factor between auto-transformer and star-delta equipment rather than the actual size of the drive. Good examples of the simpler and cheaper form of control (star-delta) are to be seen in the two 10-h.p. B.T.H. s.c. units which serve, through worm reduction gearing and chains, two worm conveyors that feed "Vim" powder to packing machines below.

Centralised control is shown at its best, we think, in the



A pair of 10-h.p. drives with worm reduction and chain for powder soap conveyors

system at the dock for the conveyance of oil-bearing seeds. There are three very large receiving sheds and fourteen capacious storage silos, as well as an Avery three-ton automatic weighing plant on the quay, and these are interconnected by a somewhat intricate system of elevators and conveyors which is extended to barge and rail-wagon loading points. By suitable manipulation the materials can be conveyed to and from different points of the system, and *via* different routes to the extent of sixty-four definitely planned operations, all of which can be conducted singly, and some two and others three at a time. Further, all these operations are normally effected automatically under centralised and supervisory control.

For any one operation the last motor in order of material transit is started by normal remote push-button control. The second starter is automatically relay operated from the first one and the third from the second, and so on. The central control board is equipped with an eleven-point selector switch and four pairs (start and stop) of push-buttons for the first motors to be operated for any of the operations—palm kernel silos, copra silos, wagon and barge. Suitable settings of the selector switches with manipulation of the required push-buttons give the operations required, with starting-up and shutting-down in the correct sequence.

Above the control panel is a cellular illuminated glass-door indication board which shows the beginning, route and end of each selected operation. To simplify the installation all the starting equipments are located in a line at the control point, and the magnitude of the achievement is made more evident by the knowledge that, of the sixteen motors employed in the scheme, twelve are of 15 h.p., 20 h.p. and 25 h.p., and also that ten miles of cable is in use for the connections.

Should any section of the system fail all those in front of it, in the order of delivery, would be automatically stopped by an elaborate system of electrical interlocking, the remaining sections being allowed to run to clear the system of material. There are remote stop buttons at various points, while the starting equipments are also arranged for hand controls. On each starter there is provision for the switch to be definitely locked out of action as protection for men working on the equipment.

As with all the other remote- and centralised-control equipment to which we have referred, the control and starting equipment for the dock scheme was manufactured by Messrs. Brookhirst Switchgear, Ltd., to the specification of Mr. R. G. Devey, M.I.E.E., chief electrical engineer to Messrs. Lever Brothers, Ltd., and the whole of the installation work was carried out by the Port Sunlight Electrical Department. Laurence Scott and English Electric motors are employed, all being s.c. three-phase units with starting equipment in accordance with the policy already indicated.

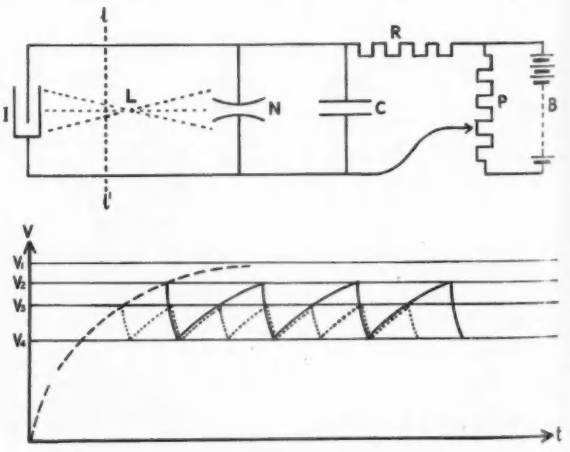
The Measurement of Radiations. By A. Stäger

A CIRCUIT, such as that indicated on the left-hand side of the line l—l′ in fig. 1 produces regular oscillations. In this diagram N is a neon lamp, C a condenser, R a resistance, P a potentiometer, and B a battery. The potential tapped by the sliding contact of the potentiometer is generally chosen a little higher than the flashing potential of the neon lamp. R may be, for example, approximately 250,000 ohms and C 1 microfarad. Such a circuit, which is in use for many purposes, can be shown to be light-sensitive when the potential of the potentiometer is very close to the flashing potential of the neon lamp.

For making the fundamental experiment the circuit must be used in a dark room and the sliding contact of the potentiometer moved until the flashing of the neon lamp occurs only, say, twice or three times a minute. When a match is lighted a few yards from the neon lamp the frequency of the oscillations increases and the number of flashes per minute, which is proportional to the quantity of light striking the electrodes, reaches ten or twenty per minute or even more.

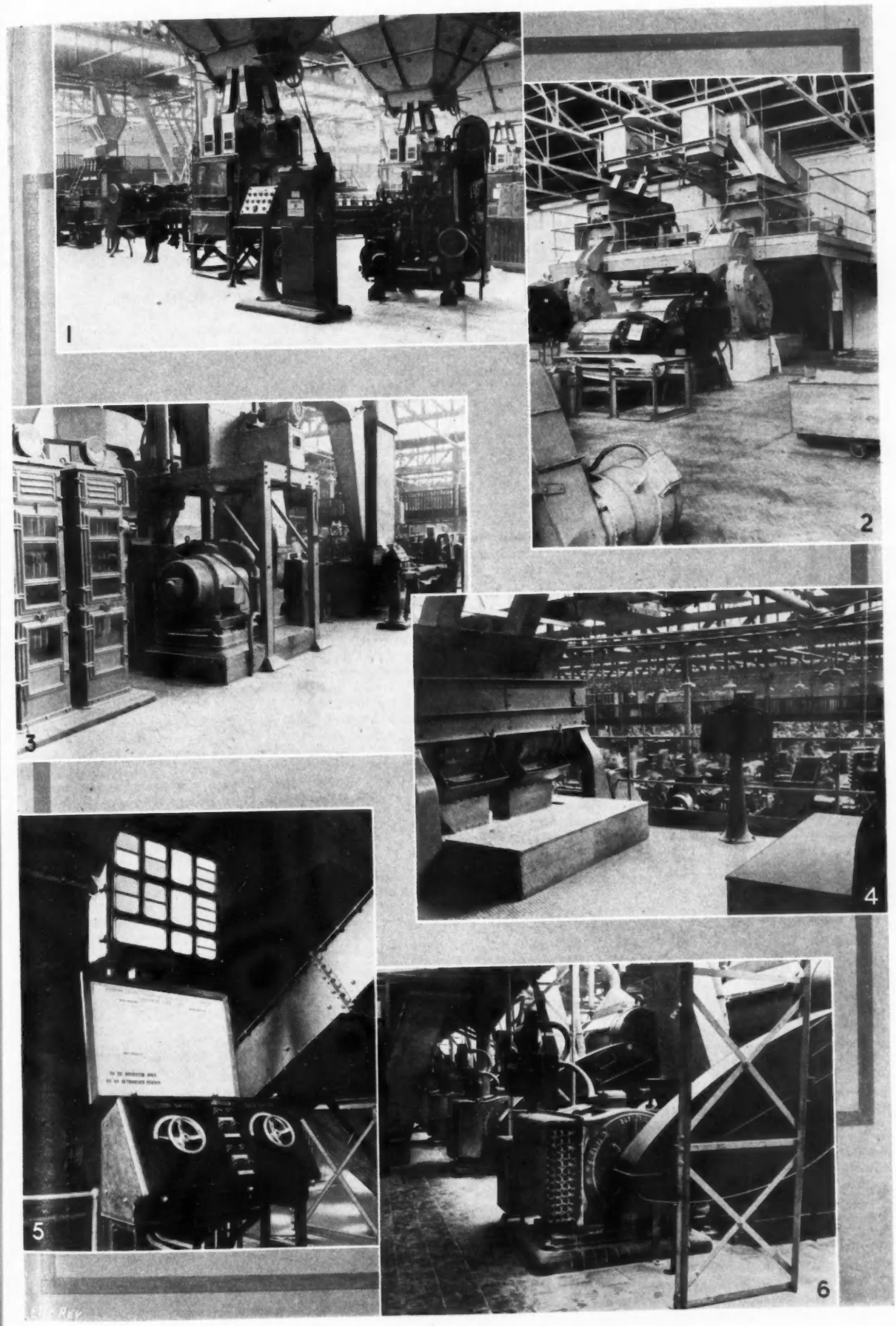
The explanation of the results of this experiment is that the electrodes of most neon lamps are more or less photo-electric; *i.e.*, the rays of visible light and also those of ultra-violet light especially, liberate electrons from the surface of the electrodes. Between the electrodes there exists an electric field. Under the influence of this field the electrons move quickly and thus produce ionisation of the gas contained within the lamp. Each new ion produces further ions, and when the ionisation current reaches a certain point, the lamp flashes. This sort of discharge may occur below the flashing potential measured in the dark room. In fig. 2 the dotted line (large dots) shows the increase of potential measured at the electrodes of the neon lamp as a function of the time. The level V_1 represents the potential when the circuit is switched off at the potentiometer; V_2 that at which the flashing point is reached in the dark; and V_3 that at which the discharge occurs when a certain amount of light is striking the surface of the electrodes of the neon lamp. This diagram shows the saw-shaped full curve corresponding to the oscillations in the dark; the dotted curve (small dots) represents the oscillations when radiation is striking the electrodes of the neon lamp. In fig. 2 the frequency of this curve is twice that of the other one. V_4 is the potential at which discharging stops.

The neon lamp in this circuit is not only sensitive to visible and ultra-violet light, but also X-rays and gamma-rays of radio-active substances. There is still another possibility of influencing the frequency by radiation. On the left hand side of the line l—l′ in fig. 1 there is an isolation chamber I connected to the neon lamp. When penetrating radiation affects the gas within the chamber it acts as a high resistance which increases the time necessary to reach the flashing point.



Figs. 1 (top) and 2

There are many possibilities of practical adaptations of this method for technical as well as for general scientific purposes. It can be used, for instance, to measure visible, infra-red or ultra-violet light and as a dosimeter for X-rays. One of its main advantages is simplicity. Unlike the current produced by a photo-cell, the flashes of the neon lamp are of a considerable strength, the current being about 1 mA.



Some Phases in the Manufacture of Soap Products

1. Multi-motor driven packing and weighing machine. 2. Conveying and mixing system with nine-point control feeding milling plant at a lower level. 3. Six-point control system for refining, plodding and tabletting equipment. 4. Control pillar of nine-point centrally controlled conveyor and mixing system feeding the toilet soap department. 5. Remote control and selector panel and (above) indicator board of the dock scheme. 6. 75-h.p., s.c. motor gear and chain drive for soap flaking mill, together with auto-transformer oil circuit-breaker and isolator.

Rectifier Practice.

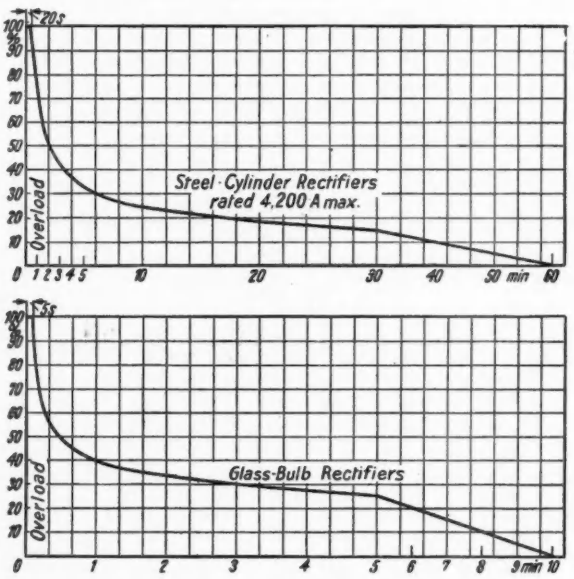
By S. H. Hemsley, B.Sc., A.M.I.E.E.

New draft regulations in Germany

THE draft Rules for Current Convertors (V.D.E. 0555/1936) that have been drawn up by a committee, of which Dr. E.h.M. Schenkel is chairman, formed from representative manufacturers and users of rectifiers in Germany, have been published with a view to constructive criticism. They cover only plant of the steel-cylinder or glass-bulb type having a mercury-pool cathode or hot cathode, with or without grid control, and rated at upwards of 100 A and a maximum of 4,000 V d.c.

The draft is divided into three main sections, namely, the scope and application of the rules; definitions and explanations of terms used; and a concise statement of the limits and values fixed by the rules. The rules apply to stationary and portable rectifier plant the manufacture of which is commenced after September 1st, 1936, including transformers and current dividers connected in the anode circuit between rectifier and transformer, phase-equalising equipment such as the absorption reactance coil, voltage regulating equipment of the step or continuously variable type, and grid control apparatus.

The rated voltage of the rectifier, without grid or voltage control, is the maximum d.c. voltage obtainable at the rated output. When grid or voltage control equipment is included (a) the maximum d.c. voltage at the rated output and (b) the lowest d.c. voltage at 10 per cent. of the full rated current value are given. When variations in the primary voltage are included (a) is taken as applying to the lowest and (b) to the highest primary voltage. The efficiency is the ratio of the power output to the power input for the whole plant. Power factor is defined as the ratio λ of the true power input to the apparent input; it is given as the product of the displacement factor (the cosine of the angle ϕ between the voltage and current of the fundamental component) and the distortion factor, v or $\lambda = v \cdot \cos \phi$ (the ratio of the effective value of the fundamental component of the line current to the effective value of the resultant current).


20s
Steel-Cylinder Rectifiers rated 4,200 A max.
Overload
1 2 3 4 5 10 20 30 40 50 min 60
5s
Glass-Bulb Rectifiers
Overload
0 1 2 3 4 5 6 7 8 9 min 10

Permissible overloads for steel-cylinder rectifiers with a maximum rated capacity of 4,200-A (top) and glass-bulb rectifiers (below)

The impedance voltage of the rectifier transformer is the voltage that must be applied to the primary winding, with the secondary winding short-circuited, to cause the rated primary current to flow in the primary winding, and rated impedance voltage, μ_k, is expressed as a percentage of the rated primary voltage. Short-circuit loss of the transformer includes losses in windings and leads at normal full-load temperature. Regulation of a rectifier plant is the difference between the d.c. voltages at 10 per cent. of the rated current and at normal full load current, assuming that the wave-form of the primary voltage remains unaltered; it is expressed as a percentage of the rated d.c. voltage.

The transformer connections are tabulated in two main sections (three- to three-phase and three- to six-phase). Two of the inter-star connections shown differ from the corresponding standards in B.S.S.171/1927. The primary and secondary connection diagrams are given as well as the vector diagrams and, for three-phase transformers, both windings are lettered U V W in accordance with standard Continental practice. The primary terminal marking only is given for three- to six-phase transformers, and no comment is made regarding the lettering of the secondary terminals. Certain Continental makers, however, letter these u v w with suffixes a, b, c, &c. Twelve-phase secondary connections, which are frequently used for large-capacity plant, are not included because of the number of possible combinations of connections. The phase relationship of the harmonics in the d.c. voltage and primary current is stated for the different groups, reference being made to the effect of parallel operation on the resultant harmonics in the circuit.

It is pointed out that distortion of the primary voltage wave-form depends upon the ratio of rectifier load to the total load of the network, and also upon the effective inductance and capacity of the network with its associated apparatus. Normal service is at altitudes not exceeding 3,940 ft. above sea level; for greater altitudes the characteristics of the plant may be as agreed. Tests are carried out, where possible, at the manufacturers' works. The sealing of a steel cylinder is considered satisfactory if the pressure in the cylinder, when inert, does not exceed 0.02 mm. of mercury after ten hours, when the pumps are not operating, after evacuation to a pressure of the order of 0.003 mm. of mercury.

The maximum permissible temperature rise of the rectifier and component parts is not stated, since this depends entirely upon the materials and construction of the plant. The temperature of the cooling medium, however, must not exceed (a) 35 deg. C. with direct or indirect air cooling, or 40 deg. C. in tropical or sub-tropical climates; (b) 25 deg. C. with direct or indirect water cooling. Permissible overloads for rectifiers are given in the form of curves in the accompanying diagram. The overloads may not be applied consecutively, but any one may be taken after full-load continuous operation. Overloads of more than one hour for steel-cylinder rectifiers or ten minutes for glass-bulb rectifiers are considered as continuous loads. A higher temperature is permissible for the rectifier transformer operating continuously at its rated output than that stated in V.D.E.0532/R.E.T. The recommendations of the I.E.C. draft International Rules that overload capacity for medium and heavy-duty traction plant should be 50 per cent. for two hours or 200 per cent. for five minutes after continuous full-load operation are not included.

In high-voltage tests, which are applied to steel-cylinder rectifiers at the manufacturers' works before the cylinder is evacuated, a maximum of 50 per cent. of the test voltage is applied when the switch is closed, and the increase from half to full value is applied evenly or in steps not exceeding five per cent. of the total test volts for not less than ten seconds. The full test voltage is then applied for one minute. High-voltage test values for the rectifier and rectifier transformer are given in the following tables where U_p is the effective value of the test voltage applied and U_g the maximum d.c. voltage at the rated output.

HIGH-VOLTAGE RECTIFIER TESTS.

	Section.			Test Voltage U_p
1.	Main anodes and parts of the plant connected thereto, to cylinder (steel-cylinder rectifiers only) and earth...			3 U_g+2,500 V
2.	Excitation anodes, ignition anodes. Ignition coils to cylinder (steel-cylinder rectifiers only)			1,000 V
3.	Cylinder to cathode (steel-cylinder rectifiers only) ...			100 V
4.	Cylinder and connected parts (steel-cylinder rectifiers only)	to earth	with cathode not earthed...	2 U_g+1,000 V (2,500 V minimum)
5.	Cathode and connected parts	to earth	with cathode earthed ...	100 V

HIGH-VOLTAGE TESTS FOR RECTIFIER TRANSFORMER AND AUXILIARIES.

	Section.		Test Voltage U_p
1.	Transformer	Primary windings to secondary windings and core	According to V.D.E. 0532/R.E.T. § 47, Table VII
2.	Transformer	Secondary windings to earth, and between separate sections of the winding	3 U_g+2,500 V
3.	Phase-equalising equipment, current dividers, etc., to earth		3 U_g+2,500 V

The overall efficiency only (including losses in the whole plant under normal service conditions) is guaranteed; losses in cables, smoothing equipment, and re-cooler are usually not taken into account. The efficiency is determined at the final temperature attained in operation, and may be obtained (a) directly from measurement of the power input and output, or (b) indirectly from summation of the losses. The direct method is employed to determine whether the plant complies with the guarantees for efficiency and losses, unless otherwise agreed.

Three ways of measuring the arc-drop loss are stated, namely, (a) the power method, (b) the oscillograph method, and (c) by measuring the heat carried away in the cooling water in which case a correction of 10 per cent. of the total measured loss is made to allow for radiation from the cylinder water jacket

The Really "All-Electric" House. By F. A. Elliott

MUCH has been said and written on the subject of complete domestic electrification, yet, I feel that the consumers' point of view has not been expressed sufficiently. My work puts me into constant contact with consumers' complaints, and so I feel competent to state the requirements of the domestic establishment, upon which the future of the industry largely depends.

Many builders are boosting so called "all-electric" houses, but I have yet to find one that is all-electric and at the same time reasonably priced. The types I have examined are usually equipped with a coke boiler for hot water with the possibility of an immersion heater in the tank if the prospective tenant requires one. The two main bedrooms are fitted with 2-kW panel fires, but the living rooms have open grates with a power switch plug beside them. No provision is made for heating the hall or landing, the two cold spots in a modern house. Finally, choice is given of hiring an electric or gas cooker.

It is, therefore, left to the tenant to make the house all-electric at his own convenience. Unfortunately he often lacks sufficient knowledge to do this well and yet profitably, and so, eventually, rues the day that he ever thought of the idea. Later he becomes a confirmed pessimist and runs down everything electrical. The consumers of the modern generation have overcome that inherent fear of electricity so prevalent a few years ago, and realising its cleanliness and convenience are now calling for really all-electric houses. The time has come, indeed it is long overdue, for a builders' education campaign. I believe that this has been attempted before, but only half-heartedly. This work must be thoroughly undertaken by some responsible organisation, for it has now become a public necessity.

I have made experiments in a modern six-roomed house of the type that is now being built by the thousand, and the results have been more than satisfactory. Low consumption tubular heating of the inconspicuous oval type was installed in all the rooms, including the hall and landing, having a total length of 24ft. and a total loading of 1,920 W. This was distributed as follows:—Dining-room 5 ft., drawing-room 5 ft., kitchenette 5 ft., hall 3 ft., landing 2 ft., and the two main bedrooms 2 ft. each. These points were controlled separately by tumbler switches grouped together on one board conveniently placed just inside the hall cupboard.

For additional room heating the latest type reflector fires with side reflectors were fitted and found to be far superior to the ordinary fire-bar type. The heat radiation from 750 W was such that when used in conjunction with the tubular heating, one had no need to sit close to the grate to be warm, but could be comfortable anywhere in the room. The hall and landing heating gave the advantage of being able to leave the warm dining- or drawing-rooms and go upstairs without that chilled feeling experienced during the winter months.

The house was previously fitted with a domestic boiler. This we found could only be used when the wind was in the right direction; otherwise the down draught caused the kitchen to be filled with smoke. This boiler has now been completely dismantled, and for hot water an immersion heater has been fitted to the tank. To ensure a constant supply of small amounts of hot water, such as are normally required, a rather novel idea has been incorporated. This consists of a thermostat in circuit with half the element; 3 kW is used with a three-heat switch, and when the control is turned to "medium" 1½ kW is controlled by the thermostat, and when switched to "low" 750 W is similarly controlled. The depth of the tank is 22 in., the heater 18 in. and the thermostat 9 in. With the temperature set at 140 deg. F. plenty of water for ordinary household needs is obtained, and for baths the switch is merely turned to "high," bringing the other half of the element into use to heat the lower portion of the tank. The tank is efficiently lagged so that the losses are very small.

The house was also equipped with the latest type of electric cooker, wash-boiler, kettle, iron and vacuum cleaner, also lighting that was in no way stinted. These tests were carried out over a period of about twelve months, and the difference between the total running costs of the installation and that comprising a modern gas cooker and domestic boiler and ordinary coal fires was so small as to amount merely to pence, whilst the difference in results was remarkable.

An all-electric house built as such would, of course, be much cheaper, for, as against the initial cost of the electrical fittings, the builder could leave out all chimneys and fireplaces merely providing surrounds for the electric fires. Also the domestic boiler installation could be dispensed with.

It is absolutely essential that reliable apparatus should be installed and not just a cheap variety of radiators and fittings that are frequently unsuitable for their job. Builders must be made to understand that the public will not have trash, but very rightly demand the best that modern science can supply.

Large Transforming and Frequency Changing Plant

SEVEN new single-phase transformers for stepping down from 287 kV to 132 kV are being manufactured by the Westinghouse Company of America for the Bureau of Power and Light, City of Los Angeles, and will be connected on the receiving end of the Boulder Dam line at Los Angeles. They will be self-cooled and will each carry 48,750 kVA, but with the air blast system in operation the full load continuous capacity will be raised to 65,000 kVA, with 80,000 kVA possible for two hour stretches. Each transformer will weigh about 150 tons, with oil, and will cover a floor space of 12 by 23 ft., while the height from rail to the end of the bushing will be 36 ft.

To facilitate transportation the tanks are being built in two sections, and the core and coils will be shipped in the lower section. Because of the long line to which they will be connected low reactance will help stability, and for this reason they are being designed with a maximum reactance of 8.4 per cent., although transformers of this size usually have 16 per cent. reactance. In the testing stage the high-voltage winding was subjected to a 120-cycle pressure of 577 kV for one minute. Impulse tests applied to all the transformers were higher than any previously given to a commercial transformer, according to the modern methods of surge testing.

The tests applied were (1) a voltage just sufficient to flash over the test gap; (2) a voltage at least 90 per cent. of that just sufficient to flash-over the test gap; (3) a voltage not less than 110 per cent. of that just sufficient to flash over the test gap; (4) a voltage sufficient to flash over the transformer bushing with the test gap removed; and (5) a test applying at least as much voltage as any of those in the previous tests, but with means provided to maintain the 60-cycle voltage. The highest pressure obtained was about 1,650,000 V.

The Bureau of Power and Light also has ordered from the same company a 60,000-kVA frequency changer, which will be one of the largest ever built. It will run at 600 r.p.m. and be 53 ft. long and 16 ft. in diameter. The machine will be filled with hydrogen, the density of which is low, so reducing the machine loss and raising the rate of heat dissipation. The set is of the outdoor type, totally enclosed, and the heat will be eliminated by a re-circulating system using surface coolers. Automatic control will ensure proper operation of the hydrogen equipment. Alarms will indicate high or low gas pressures and high temperatures of windings, bearings, or hydrogen. The 50-cycle and 60-cycle machines, although initially coupled together, are designed to operate satisfactorily if mechanically disjoined. Later on it is expected that they will be operated as separate 60-cycle synchronous condensers, under which condition the ten-pole machine will be operated at 720 r.p.m.

Rectifier Practice *(Continued from preceding page)*

and anode coolers. The results of short-circuit tests on the transformer to determine the copper loss and impedance are corrected where necessary to a standard reference temperature of 75 deg. C. When the transformer connections are delta/double star (without absorption reactance coil) the primary current is to be taken as $\sqrt{3}/\sqrt{2}$ or 1.23 times the rated primary current.

Guaranteed values of power factor and displacement factor are given only when mutually agreed. The power factor λ is determined from the useful power input N_w, the rated primary voltage U, and the rated primary current I from the relation $\lambda = N_w/\sqrt{3}UI$. The displacement factor is calculated from N_w and the reactive power input N_b according to

$$\cos\phi = N_w/\sqrt{N_w^2 + N^2b}.$$

TOLERANCES.

		Tolerance.
1.	D.C. voltage	±1.5% of the rated voltage.
2.	Voltage regulation... ...	±15% of the guaranteed regulation.
3.	Efficiency	±1%
4.	Power factor λ ... ... At 100% of rated output	±2% of the declared value.
	Displacement factor cos ϕ... At 75% of rated output	±2% " "
	At 50% of rated output	±3% " "

Domestic Service Failures. By J. Bland

An analysis of the causes

In the course of my work I have to replace a great many fuses, and in an attempt to reduce the possibility of service failure I have kept an account of the causes. During a period of a little over two months I have replaced 200 lighting circuit fuses, and about fifty heating circuit fuses, all on domestic premises. The results are shown in table I.

TABLE I: LIGHTING CIRCUITS.

Cause.	Percentage.
Premature failure of lamps causing short-circuits...	42
Faulty flexibles	36
Faults in structural wiring	5
Undetermined causes (probably oxidisation of fuse wire and consequent reduction of cross-sectional area)	6
Other causes	11

The two most surprising facts which emerge from this analysis are the regrettably high percentage of failures due to faulty lamps; and the very small number of faults in the structural wiring itself.

Table II shows that the offending lamps were not by any means all of the cheap foreign variety.

TABLE II: TYPES OF LAMPS CAUSING CIRCUIT FAILURE.

	Percentage.
E.L.M.A. standard gasfilled lamps, used vertically, with cap upwards	12
E.L.M.A. standard gasfilled lamps used horizontally, or vertically, with cap downwards...	22
E.L.M.A. special shape lamps (*i.e.*, candle, plain, flame, Gothic, etc.)	14
E.L.M.A. vacuum lamps	none
Cheap non-association lamps, all types	52

It should be pointed out, however, that most of the consumers concerned used E.L.M.A. lamps exclusively, which fact accounts for the high percentage of failures due to this cause. The coiled-coil filament lamps appears just as prone to failure owing to internal short-circuits as the older type. The use of gasfilled lamps in standards appears to increase the risk, so, providing a 60-W vacuum lamp gives sufficient light, I always recommend the latter type for "upside-down" burning.

The 36 per cent. of failures accounted for by faulty flexibles was due in nearly every case to the use of the cheaper kinds of single vulcanised wire, and the "short" usually occurred where it entered the plug head or lampholder. The relatively thick covering of good quality double vulcanised flexible appears to serve the purpose of keeping the conductors apart, and as a consequence a fracture only results in the failure of the particular lamp or pendant which is involved.

Although much inferior wiring has been carried out in the district concerned, recent house to house tests and inspections by the local supply authority have resulted in large quantities of unearthed lead-covered and slip conduit work being efficiently bonded and earthed. Even so, only ten fuses out of 200 were traced to earths on the wiring.

This installation inspection, rendered necessary by a change-over to a.c., has its reflection in the first item of the third table, which shows how the universal use of 3-pin plugs and earthed radiator casings have added still another possible cause of fusing.

TABLE III: HEATING CIRCUITS.

Cause.	Percentage.
Conductor or spiral coming into contact with earthed casing ...	14
Overload (usually main fuse)	26
Faulty flexibles	32
Faults in structural wiring	10
Undetermined causes (probably oxidised fuse wire or loose connections on fuse-carrier)	12
Other causes	6

The recent cold weather accounts for the large number of overloads. Many households have been using their maximum heating load, with perhaps the addition of 3 or 4 kW of new fires for an hour or so in the mornings, a state of affairs which has not been necessary for a year or more.

Of faulty flexibles, as might be expected, about three-quarters were due to those of small portable appliances, such as irons, kettles and small fires.

The breakdown of the insulation of synthetic resinous plug-heads between the live and earthing pins accounted for two failures.

To sum up, it cannot be said that any startling facts emerge from the above analysis; we already know that the use of good quality materials and accessories reduces the possibility of fusing. However, I consider the experiment was justified, because if the "domestic units consumed" are to materially increase the householder must be assured of reliability. We know that the fuse is a safety valve, and that electricity is the only form of power that automatically cuts itself off in the event of a fault arising, but no amount of talking will convince domestic consumers that it is a desirable thing for his lights to go out during a dinner party!

"Snags." By Motor-maker

"A QUARTER horse-power ought to eat the job, but we will ask for a half and be safe," said a maker of machine tools on a summer day. When tried, the sample ½-h.p. motor justified his estimate and led to his placing a bulk order. Christmas came, and with it letters, 'phone calls, and finally a telegram from him: "Motors not up to sample. Lack power. Returning. . . ."

A machine fitted with a "dud" motor duly arrived back at the works, and the complaint appeared to be justified for it would scarcely reach full speed on no-load. Meters hurriedly inserted showed that the motor was developing nearly 1 h.p. although there was no useful output from the machine. The trouble was finally traced to a gear box used for speed reduction.

A heavy grade of oil, which had been satisfactory in summer, had so thickened with the cold that the motor was nearly stalled in driving the gears round alone. Substitution of a suitable grade of oil restored the performance to that of the sample and all was well.

Over-estimated Torque

Rather different was a complaint from a paper mill. A new development was in hand which required a variable-speed a.c. drive. The power was estimated and a slip-ring machine ordered to have the required bottom speed by rotor control. The customer reported that with the controller all in he was getting three times the speed he wanted. A new regulator failed to make enough correction and it was necessary to reconnect the stator from mesh to star, thus reducing the motor torque to one third, while still using the large regulator. The trouble had been caused by over-estimating the required torque in the first instance, but this experience demonstrated that a slip-ring motor is not suitable for giving large speed reductions at very low loads.

Usually, however, troubles are of the first type. The difference in power required before and after "running-in" a machine is not always realised. A rotary compressor provided a good example of this. Much experimental work had been done on the output side before the final requirements were settled. Power inputs were then measured and a line of motors ordered. When these were put into service a large number of burnouts was experienced. It was gradually noticed, however, that where a motor stood up successfully for the first few days, it did not develop trouble later. Investigation showed that the compressors, as received from the makers, might take anything up to 125 per cent. of the motor output when running light, due to the very close clearances involved. The trouble was finally cured by running-in the compressors at the works with a special motor until the input had fallen to a safe value.

Too-frequent Reversals

On another occasion a 'phone query "Are your three-phase motors suitable for reversing on no-load?" was given a hasty affirmative and the matter was then forgotten. An order materialised at a later date. The first motor burnt out after a few hours service and the machine sent to replace it suffered the same fate. A more precise inquiry as to the duty revealed that the rate of reversal was about twenty to the minute. In such circumstances reversing the kinetic energy of the rotor itself may cause a greater load than that due to the driven apparatus, and here was a case in point. Analysis suggested an entirely special machine, and one having a small diameter and long core, to reduce the inertia, was developed. This solved the problem satisfactorily, but since that day the mention of "reversing duty" calls forth an instant rejoinder "how many times?"

A source of trouble that is not uncommon is illustrated by the following case. A firm of motor manufacturers was trying to "tie up" with the makers of a portable tool and supplied a machine for a demonstration set. They received a complaint that, not only was their motor no good, but that through its failure a large contract had been lost. They demanded a test in their own works and came through the ordeal successfully. When the matter was sifted it was found that the demonstration motor, designed for 230 V, had been used in a district where the nominal voltage was 200, but where excessive line drop actually reduced it to 140. Since the torque of an induction motor varies as the square of the terminal voltage the result was not surprising!

Fractional H.P. Single-phase Motors.

By E. K. Bottle, A.M.I.E.E.

Factors governing their suitability for different types of load

THE selection of a small single-phase motor to do a given job involves more than looking through catalogues to find a nominal output and speed which seem reasonable. The effect of normal variations in the quality of the driven machine should be investigated with reference to any special properties of the motor in question. The smaller the job the more important become stray losses in relation to the useful load.

Single-phase motors are of two main types, namely, induction and series. Speed, which is approximately constant in the former, varies inversely with load in the latter. The number of speeds available with an induction motor is limited and is rigidly tied up with the supply frequency. In practice, the choice is restricted to 930, 1,430 or 2,850 r.p.m. on 50 cycles. The series motor, in its usual two-pole form, is essentially a high-speed machine, being most useful above 5,000 r.p.m. There is no definite relation between speed and frequency. A study of the speed-torque characteristic of each type shows that the machines are not equally suitable for all classes of work.

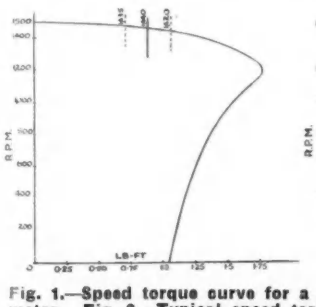
The split-phase motor, whether using resistance or capacity at starting, has a squirrel-cage rotor which runs at about seven per cent. below synchronous speed and is insensitive to small changes in load. The speed drop from cold to hot is only two per cent., and at about twice full-load torque it still runs at eighty per cent. of full-load speed. At greater loads, however, it stalls suddenly. Thus a variation of twenty per cent. in torque, such as may easily be caused by friction in small appliances, only affects the speed by one per cent.

This type of motor formerly had a bad name for starting performance, but owing to the introduction of condensers for phase-splitting it can now be started against more than the stalling load. Induction machines will run for long periods without attention and can be made nearly silent, while they do not cause radio interference. Although their low speeds make them suitable for direct-coupling to some loads, the fixed relation between speed and frequency is a disadvantage since it is impossible to obtain the same speeds on, for example, 33, 40 and 50 cycles. Induction motor sizes and prices do not decrease in proportion to output when this is small, but they become competitive above 1/10 h.p.

For outputs below 1/50 h.p. the "shaded pole" construction enables squirrel-cage machines to be made smaller and cheaper than the type just considered, but this is done at the expense of performance. The speed-torque curve drops rapidly, making the machine more sensitive to load variations. The overload capacity is relatively low and, moreover, the starting torque is poor.

The repulsion-start motor was originally developed to give high starting torque for low current. Once up to speed it behaves like a squirrel-cage machine. Its rather complex construction limits its usefulness to ¼ h.p. and over. Direct-coupled pumps and compressors are a common form of load, but for fractional h.p. ratings it is to some extent being replaced by the condenser-start squirrel-cage motor.

A variation on the induction principle is the "synchronous-reaction" motor. This is suitable for certain special appli-



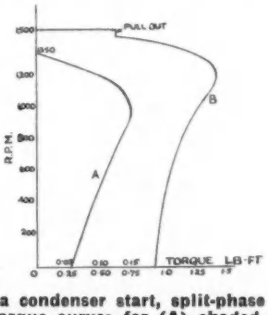


Fig. 1.—Speed torque curve for a condenser start, split-phase motor. Fig. 2.—Typical speed torque curves for (A) shaded-pole and (B) synchronous reaction motors

cations where absolute constancy of speed is required. In construction it follows the squirrel-cage motor, but the rotor is cut away to form salient poles. Starting is similar to a split-phase machine. When the speed approaches synchronism the rotor pulls into step and locks with the rotating field. In this condition it will carry load at an unvarying speed until a critical value is passed, when it falls out of step and continues to run as an induction motor.

Synchronous-reaction motors are relatively large, having about 33 per cent. of the induction output with the same frame. They are low in power-factor and should not be confused with the larger type of synchronous motor which requires a d.c. excitation and can be used for power-factor correction.

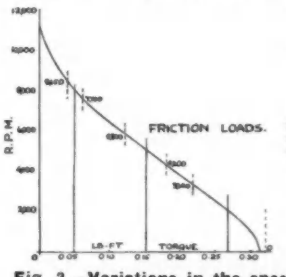
The a.c. series motor has two features which make it popular in the domestic appliance field. At high speeds its performance is insensitive to the supply frequency; this does not hold to the extent of giving identical speed-torque curves on all frequencies, but one point can usually be made coincident on all the curves provided that the speed is high, say, over 5,000 r.p.m. The second feature is its adaptability to speed control by voltage variation, *e.g.*, with a series resistance.

A slight digression is here necessary. The load on a motor may be either of two kinds, namely "constant-torque" or "variable-torque." In the first, of which friction is an example, the torque required to drive the apparatus is unaffected by the speed at which it is driven. In the second the torque is a function of the instantaneous speed. This is typified by the fan, which requires a torque proportional to the square of the r.p.m.

Where commercially produced articles are concerned, however, there is another type of variation. This is between the individual and the average. The motor is always specified for the latter. The degree of variation allowed is a matter of production policy, but some is inevitable. In small mass-produced lines it may be of the order of ± 20 per cent. of the mean value.

The effect on the motor of the tolerance allowed to the driven member can be followed in fig. 3, which illustrates the case of a friction ("constant") load torque. Three average values have been selected which would cause the motor to run at 8,000, 5,000, and 2,000 r.p.m., respectively, and on each side of these are marked the limits of variability. For 20 per cent. deviation in torque the corresponding variations in speed are 12, 42 and 165 per cent. The least instability occurs at the top of the curve, while at low speeds the assumed tolerance in torque would stall the motor.

In fig. 4 the method has been applied to a fan load. The same three speeds have been taken. Curves of the torque required to drive an average fan are drawn through these points. On each side are added curves representing the limits



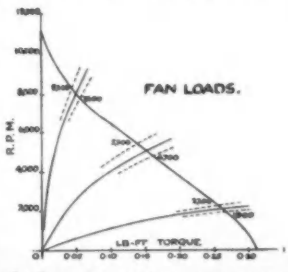


Fig. 3.—Variations in the speed of an a.c. series motor corresponding to changes of ±20 per cent. torque on a friction load. Fig. 4.—The same on a fan load

of 20 per cent. torque. The intersection of these with the motor speed-torque curve gives the appropriate limits of speed. In this case the gross variations are only 5, 12 and 15 per cent., indicating that the motor is relatively stable on fan load even at a low speed. Thus a series motor is well suited to such a load and, for a given supply frequency, a wide choice of speed is available. On the other hand, a friction load, when subject to normal tolerances, leads to instability which can be minimised only by selecting a high speed.

On the mechanical side, the series motor requires some maintenance due to brushwear. Its high speed tends to make it noisy and, unless precautions are taken, it may cause radio interference. Where a low speed final drive is required, high gear ratios are necessary and this introduces further troubles as the gear friction may be a large part of the total load and so lead to inconstant speeds. Even with constant mechanical loading, considerable speed variation must be expected as the machine warms up, due to increased resistance drop, and this is most marked in the case of the smaller sizes.

In spite of these drawbacks the series motor is an inexpensive and very useful piece of apparatus. Its chief application is for high-speed blowers on vacuum cleaners and hair dryers. It is extensively used for light jobs where cheapness and small size are important considerations. Since these are usually friction loads with a low-speed final belt drive the series motor does not represent the best technical solution, but combined with an adjustable resistance it will give fairly satisfactory results at a lower cost than by any other method.

Maximum kVA Demand.

By G. W. Stubbings, B.Sc., A.M.I.E.E.

A novel method of assessing charges

IN the recent report of a committee appointed by the Federation of British Industries to deal with the basis of two-part tariffs for industrial power supplies, reference is made to two matters of considerable technical importance. The first relates to the method of measuring maximum demand, and the second to the method of power factor adjustment. The Committee recommends that the type of instrument used should record with a satisfactory degree of accuracy the maximum average load as measured during successive thirty-minute periods and that adjustment of the demand charge should be made automatically by measuring this demand in kVA.

The expression "satisfactory accuracy" is ambiguous and the suitability of the methods of demand measurement used in some well known types of indicators will depend upon how this is interpreted. In an indicator which measures average demand with theoretical accuracy the rate of angular advance of the indicator pointer is constant with a constant load passing the instrument. In other words, a theoretically accurate averaging instrument will give the same readings, first with half the rated load passing for the whole of the averaging period, and then for the whole rated load passing for half the averaging period, the load during the remaining half being nil. Only demand indicators operated by meters of the watt-hour type will conform exactly to this requirement. In regard to indicators of other types, in which compliance with such a test is not exact, the time is ripe for some sort of official pronouncement as to the maximum deviation permissible between two such sets of readings.

A point of equal technical interest is the recommendation to measure maximum demand in kVA. This recommendation, taken in conjunction with that relating to the method of measuring demand, virtually stipulates the use of an indicator embodying some device for the vector summation of kWh and reactive kVAh. The value of the apparent power obtained by such a summation for a three-phase circuit is known as the total equivalent kVA.

Proposals have been made for the continuous integration of kVA in a.c. circuits by using d.c. meter elements in conjunction with a rectifying device, but so far commercial rectifier-operated three-phase kVA meters are not available. Even if such a meter were available for the measurement of three-phase kVA demand, notwithstanding that it would furnish a true average value over the averaging period, this value would be physically different from that given by a combination of a watt-hour meter and a reactive voltampere meter. The difference between the values of a demand as measured by the two methods would certainly be inappreciable for approximately balanced loads but, in conditions of considerable dissymmetry of loading, would become sufficient to raise a question as to which method of measurement was the correct one.

Complicated Meters

At present the only commercial meters giving true average maximum kVA demand indications for three-phase circuits are those in which the registrations of a kWh and a kVARh element are combined vectorially to give a value of total equivalent kVAh. Of these meters there are two types. In one the method of vectorial summation is theoretically accurate, in the other it is approximate, but the errors do not exceed those allowable in good metering practice. In each case, however, the summation has to be effected by a mechanical device which is complicated and costly. For many years meter experts have been endeavouring to evolve a simple solution of the problem of three-phase kVA integration, and if, as seems justifiable, the two available types of kVA meters are considered as unduly complicated in construction, then the problem has not been solved.

This point is stressed because it seems to be somewhat regrettable that the committee appointed for the purpose of considering the question of demand measurement has reported in favour of a method which can only be carried out by meters of complicated construction. I would suggest that the whole matter of the assessment of the demand charge for three-phase a.c. supplies should be reconsidered, and some simple method evolved whereby a measured kW demand might be corrected for power factor variation in a way which could be readily comprehended by the consumer.

It is probable that in industrial power loads the peak values of the kW and the kVA demand occur simultaneously. These two values are connected by a quantity which may be called the peak load power factor. The quantity, maximum kVA, is usually considered a suitable one for assessing a demand charge, because it is supposed to be proportional to the standing charges incident to the cost of the supply. This proportionality is far from exact, because certain components of the standing charge per kW of demand incident to a supply are nearly independent of the power factor. It would therefore be quite rational to obtain a value of the maximum kVA for assessment of the demand charge from measured values of the peak kW and some easily measured value of the average power factor.

Now a rational value of the average power factor of a consumer's supply can be obtained from the registrations of kWh and kVARh meters. The value so obtained certainly is not generally equal to the time average of the power factor, nor to the ratio of kWh to true kVAh, but it is a value which, having been defined, can be measured with high commercial accuracy, since the kVARh meter is an instrument the inherent errors of which are little, if any, in excess of those of a standard kWh meter. If, therefore, a value of maximum kVA demand for assessment purposes could be obtained from a measured value of maximum kW demand and a measured value of average power factor depending upon kWh and kVARh registration, metering difficulties would be solved, since a standard three-phase watt-hour meter, by the use of simple external phase-compensating devices, can be used for kVARh measurement.

At this stage of our argument another difficulty presents itself. The registrations of kWh and kVARh give rise immediately to a ratio which may be called the tangent of an angle. From this ratio, tan ϕ, a cosine value can be obtained which represents the average power factor value by which the measured kW demand has to be adjusted. The conversion of the ratio kVARh/kWh can be carried out by an algebraic formula, by the use of trigonometrical tables, by a graph, or by a line chart or nomograph. All these methods are objectionable, since the process by which the kW demand is adjusted by means of the registered kW and kVARh consumptions must be stipulated in the agreement for the supply, and the arithmetical working must be shown on the consumer's account. By whatever process the conversion of the measured tangent of an angle is converted into a cosine or secant value for the adjustment of a kW demand for assessment purposes, it will be understood by only a few consumers.

A Simple Formula

It is, however, quite unnecessary to correct a measured value of kW by a mathematically exact formula. An approximate method which can be explained and stipulated in readily understood terms is not only legitimate but desirable for commercial purposes. When the registration of an electricity meter is converted, by the application of a numerical constant, into a money charge, the value of the constant is settled by considerations of expediency and with no pretensions to mathematical accuracy, notwithstanding that the physical quantity upon which the money charge is based is measured with as high a degree of accuracy as is commercially possible. A simple and easily understood formula whereby a kW demand can be approximately converted into kVA from the registrations of kWh and kVARh is readily obtained.

The mathematical process of converting kW to kVA is equivalent to increasing the measured value of the kW by a factor which is equal to (sec ϕ−1). The kW and kVARh meters lead to the ratio tan ϕ. In fig. 1 is shown the functional relationship between these two quantities and for values of tan ϕ greater than 0.6 this relationship is approximately linear. Suppose then that the normal kW demand charge is based upon a power factor of 0.86, corresponding to an average value of tan ϕ equal to 0.6. Then, for values of tan ϕ in excess of 0.6, power factor compensation of the measured demand is very approximately obtained by increasing this demand by a factor proportional to this excess. Similarly, compensation for power factors higher than that corresponding to tan ϕ=0.6, can be obtained, but not so exactly, by decreasing the measured kW by a factor proportional to the difference between 0.6 and the measured value of tan ϕ. The dotted lines in fig. 1 show the approximate values of the correcting factor (sec ϕ−1) obtained by these simple proportional relations.

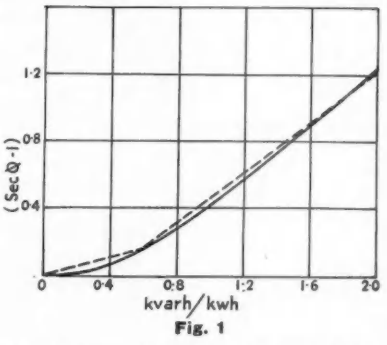


Fig. 1

The application of this method of power factor adjustment

of the demand charge of a power supply can be stated in terms which are readily comprehended by the average consumer, whose energy and kW maximum demand is registered on one meter and whose kVARh consumption is registered on a separate meter.

The formula could be stated somewhat as follows: The indicated maximum demand is the basis for charging when the consumption of reactive units is at the rate of 60 per 100 energy units. If the reactive consumption is in excess of this figure, the metered demand is increased at the rate of 0.65 per cent. for each reactive unit in excess of 60 per 100 energy units, If the reactive consumption is less than 60 per 100 energy units, the metered demand is decreased by 0.2 per cent. for each reactive unit per 100 energy units by which the reactive consumption falls short of 60." Complications arising from a possible negative reactive consumption can be avoided by means of a ratchet mechanism fitted to the reactive meter.

Advantage of the Method

The advantage of the proposed method of power-factor adjustment is that the physical quantities involved in its application can be measured with precision and without the use of what may be called non-standard instruments. There is no reason, with such a scheme, why ordinary three-phase meters with external compensators should not be used for reactive measurements without any gearing adjustments to give direct reading. The constant required to convert the registrations of the adapted three-phase meter to kVARh can be included in the adjusting constants of the tariff formula, so that the meters used for reactive measurement are directly interchangeable with those used for normal metering. The adoption of such a straightforward scheme would remove the existing anomalies of maximum-demand measurement whereby a large component of a considerable money charge is based upon ill-defined quantities determined by makeshift and unscientific methods.

The two fundamental principles of charging for electricity supply are: first, physical quantities upon which electricity charges are based must be exactly defined and measured with as high a degree of accuracy as possible; secondly, that tariff rates, by which physical magnitudes are converted into sums of money, are determined by considerations of expediency, and consequently the question of their mathematical accuracy is irrelevant.

Registration of Contractors. By H. R. Taunton, A.M.I.E.E.

What is its future?

THE report of the Executive Committee of the National Register of Electrical Installation Contractors (Elec. Rev., April 3rd, p. 501), is interesting and in one respect pleasantly encouraging—which is an admission from one whose sympathy with the Register has always been imperfect. Of 219 applications during the year, seventy-five, or little more than a third, were accepted; and eighty-four (38 per cent.) were declined or allowed to withdraw, leaving sixty under investigation. Taking the totals for previous years from the "Registration Table," the proportion of applications declined and withdrawn was less than 24 per cent. The larger proportion in the past year was to be expected. The report suggests that it is "a result of inspection of applicants prior to registration," but this reasonable conclusion hardly goes deep enough. In the earlier years of the Register a majority of the applications must have been from firms of repute who joined it as a matter of routine; whereas it is fair to assume that most of those who deferred application were small or new firms, and, on an average, of lower grade, and therefore less likely to come up to the not very onerous standards of admission. In other words, most of the earlier applicants would have had little to fear from an inspection of their work—at least, let us hope so!—while later comers, as a class, are more open to criticism. Yet one is tempted, after all, to speculate what would have been the proportion of rejections in earlier years, had the system of inspection been then in force. Perhaps not all even of those original members whose names are "household words" would have survived the shock of a surprise test of their reputed high standards of workmanship!

That suggests the question: How many inspections of the work of existing members, as apart from applicants, are made in the course of the year? Apparently fewer than 266, from the summary on page 5 of the "Report on Inspection," that is, about 16 per cent. of the total membership. It would be interesting to know how these 266 were selected. Some were presumably inspected on specific complaints, but what about the others? Is it proposed to give all the members, whatever their reputation, a surprise visit? That would be the fair, though perhaps not the politic, thing to do; but at the present rate it would occupy six or seven years.

The net result, given in the main report, is that only 18 members have been struck off the Register since its inception (six in the last year). That is a figure not easily to be understood by any contractor who, in the course of his year's work, in a comparatively limited area, comes across thrice as many glaring examples of bad workmanship by firms of at least N.R.E.I.C. standing. The explanation is probably in the natural reluctance of the Board to expel a member so long as he can put forward an acceptable explanation of his offence, or persuade them that it will not be repeated. That is suggested by the summary already mentioned, where, against 237 adverse reports, explanations or undertakings of improvement were accepted, or the matter was dropped, in 184 cases. In 152 of the reports, it should be said, the complaints were of minor faults.

Nearing the Limit?

Coming back to the Registration Table, an interesting item is cancellations "on account of increased fee"—two. It bears out the argument that membership of any organisation is likely to be taken at its own valuation in terms of its subscription fee. There is an obvious hint in the very small number who have jibbed at the doubling of the original, too modest, fee, in view of the fact that the number registered for the year was only nine. The total at the end of the year was 1,733; at March 6th this year, 1,740. The Register seems to be nearing its limit. It would be interesting to know how many members of it are also members of the E.C.A. What would happen if all the E.C.A. members were to withdraw from it?

The gratifying feature of the report is the attached review of the year's work of the two inspectors. Long ago I wrote: "Without inspection of some sort the guarantee of good work implied by registration becomes almost worthless." All applicants are now visited by one of the inspectors, so that their wiring methods and their general qualifications can be examined on the spot. If it does nothing else, that at least removes the old criticism of the Register, that admission to it was too easy, too indiscriminate.

The report remarks that "knowledge of Regulations is essential," and goes on: "One of the results of inspection has been to show that a considerable number of applicants do not possess a copy of the I.E.E. Wiring Regulations and have little knowledge of them." Amazing! One wonders how many of them read the Electrical Review, or any other trade paper. The next paragraph states that all applicants are asked if their work will comply with the Rules; and, if not fully, from what "particular regulations . . . exemption is desired." There speaks common sense, but it is nevertheless an indirect criticism of the Rules. It ought not to be possible to tolerate any exemption from a simple code, confined to essentials.

Haphazard Testing

"Special notice has been taken of the testing apparatus used by registered contractors and the methods adopted for testing for continuity. . . ." An analysis of 1,056 reports follows. No fewer than 700, two-thirds of them, either made no test at all (165) or used only a bell (467), lamp or galvanometer! That is an extraordinary disclosure, particularly as one gathers that not only applicants but existing members are guilty. One man is recorded as using a battery and ammeter. Perhaps he had also a standard 1-ohm resistance, and so qualified for inclusion with the select band of 86 who, with a "continuity tester," were in a position to comply with Rule 1005D. Of the rest, 327 "have definitely promised to obtain and use a continuity tester," but what about the others?

The next item is very instructive: a list of a dozen "principal faults disclosed by inspection." They are much the sort one comes across in everyday experience, but it is interesting to have them tabulated, apparently in order of seriousness, from (1) switches on the wrong pole—bad, that!—to (12) c.t.s. carelessly run in roof and floor spaces. No. 2 is defective continuity, and five of the others are breaches of earthing rules. No. 8 is "overcrowding cables in conduit": a very common fault but, curiously enough, not a breach of any definite Rule—unless, perhaps, of No. 1, "good workmanship." It is a pity Table 22, of the "Capacity of Conduits," is still left optional.

The report goes on to describe the action taken on the inspectors' complaints, which varies as they are minor or more serious; and to review the results of further inspections of offenders' work. It ends with a note on the educational value of inspection: "The position disclosed . . . indicates clearly

Argentine Electrical Trade. By H. C. Siddeley

British manufacturers' prospects

In the Electrical Review of March 1st, 1935, I dealt with the British electrical trade up to the end of 1934. Tables showed the gradual fall in the value of electrical imports since 1930 both as regarded the total and British imports. The latter, however, showed a much greater decrease than the former. I expressed the view then that we could look for an increase in trade with Argentina in future years, and this is now confirmed by the 1935 figures.

Argentina has shown increased prosperity all round, both as regards her total trade and her balance of trade. The latter is very important to this country as it enables Argentina to pay her interest charges on foreign investments. The total Argentine imports in 1935 amounted to $1,175 millions, as against $1,110 millions in the previous year, an increase of $65,000,000, *i.e.*, £3,800,000 approximately. It is difficult to express exact values of Argentine imports as these are based on certain definite values given to each class, which are not always correct. For example, an electricity meter is valued for import purposes at $19.20 gold, equal to 57s., a price which manufacturers would like to obtain for an ordinary a.c. meter.

There was a favourable trade balance last year of $367,000,000 paper, equal to £24,000,000, which enabled Argentina to meet interest on foreign investments.*

The British Share

British electrical imports amounted to £454,558, an increase over 1934 of £158,631, or 52 per cent. These figures are taken from the British returns and therefore represent their f.o.b. values only. The table below gives a comparison of these imports since 1931, showing the total values and their percentages of the average value of the three years 1928-31, amounting to £1,330,000, which represented the high-water mark of Argentine purchases. For the sake of comparison, similar percentage figures are given for the total electrical imports.

	1931.	1932.	1933.	1934.	1935.
Value of British electrical imports	£736,000	244,800	202,215	295,927	454,558
Percentage of average value, 1928-31... ...	56	19	16	23	34
Percentage of total Argentine electrical imports...	75	62	62	61	62 (estimated)

British electrical imports fell off after 1931 due to the completion of certain railway electrification work. Railway purchases further diminished in the following years due to a fall in receipts and a drop in exchange.

All British interests in electricity supply companies have been sold to American and other foreign investors, which has also had an effect on British trade. British manufacturers had therefore to find fresh outlets for trade and the results show that this is being accomplished. There has been an increase in those local manufactures which depend on local raw materials, such as cotton, wool, oil, sugar, fruit, cattle, &c., all of which required electrical installations.

So far local enterprise has not interested itself largely in electrical manufacture, with the exception of two cable works, which are branches of Continental firms. Several foreign companies are developing partial manufacture such as the cabinets for domestic refrigerators, which are made locally, and a few domestic appliances. The total electrical imports have not varied much during the last four years, so that the British increase is all the more gratifying, showing that we are competing successfully against our foreign competitors in many products.

The Roca Treaty helps our trade in some directions, especially as regards facilities for obtaining exchange at official rates, which some countries are not able to do. There are some directions, however, in which Great Britain has not benefited by this treaty to the extent promised, particularly as regards Government purchases, where our exchange benefit does not apply. No doubt some of these handicaps will be eliminated when the treaty comes up for revision at the end of this year.

British Standards are becoming better known and appreciated and are mentioned in all Government specifications, but not exclusively. For this reason British manufacturers find themselves at a disadvantage when the German V.D.E. ratings are less severe.

An Important Customer

Argentina occupies a very important position as an importing country of British manufactures. It is one of the largest buyers outside the Dominions, but as there is little discrimination between competing countries, there is extraordinarily acute international competition. All countries are well represented here, especially electrical manufacturers. Argentine purchases of British electrical materials in 1935 came sixth in the list, being only exceeded by South Africa, India, Australia, New Zealand and Ireland.

The present Argentine Government has shown itself sound and has a good record. It has introduced many useful measures to improve its financial stability. A new bankruptcy law has recently been introduced which has decreased the number and the extent of bankruptcy cases. Several of the unsound banks have been closed down and others have been grouped into more solid units. The creation of a Central Bank, as recommended by Sir Otto Niemeyer, has been accomplished, and this will result in greater financial stability in Argentina.

The Government has sanctioned the construction of a chain of grain elevators throughout the country. The first series is now about to be constructed, and consists of fourteen port elevators ranging from 140,000 tons to 10,000 tons capacity. These will all be at the various ports, but it is intended also to construct a further series in the interior to provide temporary storage for grain until required for internal consumption and for transporting to the terminal elevators for shipment. The total cost of these will be $64,000,000, of which one-third will be spent on elevator machinery and electrical machinery, cables, &c., of which Great Britain can look for a fair share. Payment for these elevators will be made from the profits which have accrued to the Government due to the difference in the rates of exchange for exports and imports. All exchange is controlled by the Government.

* This balance is calculated at an exchange value of $15 to the £, which is the standard rate applying to exports. The rate for imports is $17 to the £.

Registration of Contractors (*Continued from preceding page*)

that inspections by the National Register are exerting a considerable educational influence which, it is felt, cannot fail to result in obtaining and maintaining a higher standard of wiring work generally." A little self-congratulation, for which there is, indeed, some justification.

Finally we have: "With the continued and extended support of engineers of supply authorities, consulting engineers, architects and others . . . the effectiveness of the Register's efforts . . . can be greatly expanded." A yearning note can be detected in that "extended." The supply authorities, the consulting engineers, yea, even the Illuminating Engineering Society, are represented on the Council—but do they support the Register in their specifications? The answer, which everyone knows, is suggested by the absence from the present report of the grateful appreciation which appeared in one or two of the earlier reports.

The truth of the matter—and no one can seriously dispute it—is that no consultant or other engineer can be expected to accept membership of the N.R.E.I.C. as any guarantee of the quality of work he requires. In short, though his associations may have helped to father it, he has not the same confidence in the *cachet* bestowed by it as he has in, shall we say, that of the Electrical Contractors' Association.

There you have the crux of the matter. A register of qualified contractors, checked by a system of inspection, is in essence an excellent thing; indeed, in some form or other, an obvious necessity. But the N.R.E.I.C., governed by an *olla podrida* of remotely associated interests, is overshadowed by an older, stronger, more exclusive and authoritative organisation, the E.C.A., governed, as any trade organisation should be, by the trade itself. The National Register of Electrical Installation Contractors is conspicuously a second-best, a superfluity.

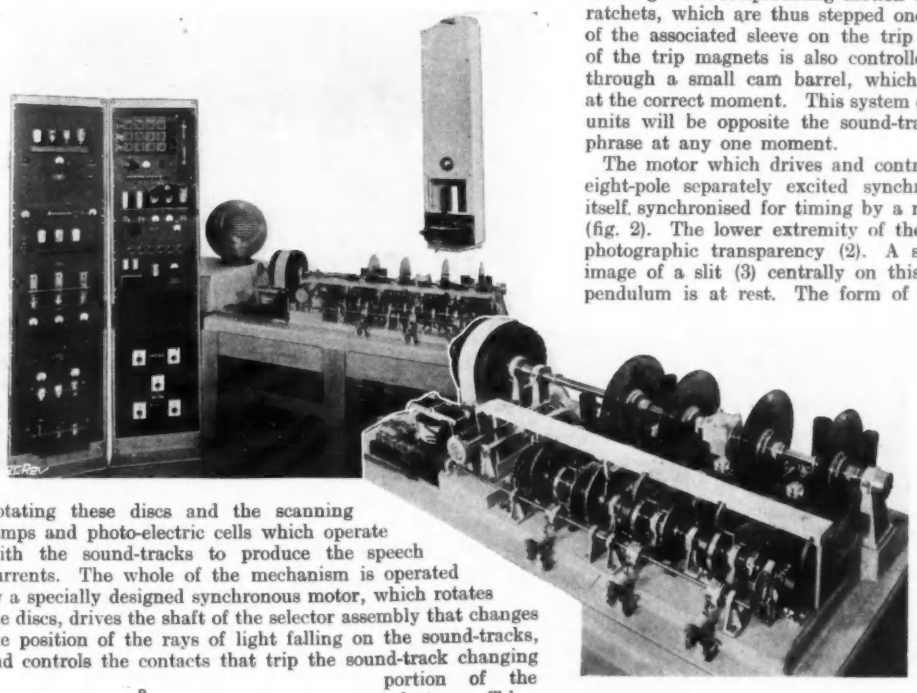
The present report tells us that, following a conference between the two bodies, a sub-committee is dealing "with the various heads under which closer collaboration is possible." The most satisfactory form close collaboration could take would be absorption of the Register by the Association. That could be easily brought about—the E.C.A. has so obviously the whip-hand—and it is a perfectly feasible solution. It would avoid the anomaly of dual organisations; the interests of N.R.E.I.C. members not qualified for full admission to the E.C.A. could be met by creating for them a lower grade of the Association; while those who are already full members of it would still have the quite satisfactory status that they enjoyed before the Register was ever mooted.

Time by Telephone

The new Post Office "speaking clock" described

As announced in the Electrical Review of March 27th, a new service enabling London telephone subscribers to receive the correct time (to the nearest ten seconds) by dialling "TIM" is scheduled for inauguration on July 1st. The listener will hear a spoken phrase, which will be reproduced from recorded sound-tracks, somewhat as follows: "At the third stroke it will be four-fourteen and thirty seconds." Then there will be three "pips," the last being the time stated.

The main portion of the device consists of circular glass discs bearing the various sound-tracks, the mechanism for rotating these discs and the scanning lamps and photo-electric cells which operate with the sound-tracks to produce the speech currents. The whole of the mechanism is operated by a specially designed synchronous motor, which rotates the discs, drives the shaft of the selector assembly that changes the position of the rays of light falling on the sound-tracks, and controls the contacts that trip the sound-track changing portion of the selector. The recorded sound-tracks themselves are very similar to those used for sound-films, and each complete spoken phrase, as heard by the listener, is made up of parts of phrases selected automatically from the various discs by the scanning mechanism. Each disc is provided with its own scanner, consisting of a small lamp and a system of lenses which focus a ray of light on the sound-track. Opposite this ray is a photo-electric cell, and between them rotates the disc; the track which is opposite the ray causes the variations in light that actuate the cell. The scanners are mounted in carriers, which can be moved across the width of the discs to allow the rays to fall on any of the various tracks, and selective cams vary the positions of these carriers as required.



Various components of the "speaking clock," and (right) a larger scale photograph of the mechanism

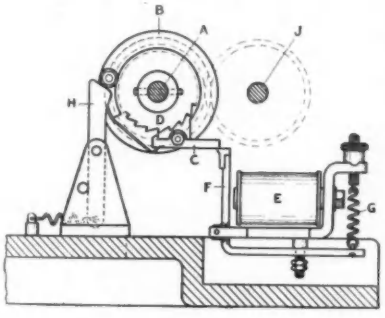


Fig. 1

The carrier movements are made by pawls, which step ratchet wheels attached to the cams at appropriate time intervals (fig. 1). The driving motor continuously rotates a shaft (A) mounted in front of the cams, and on this shaft are three ratchet wheels (D), one each for the hours, minutes, and seconds. Mounted freely on the spindle and close against each ratchet wheel is a sleeve (B) which carries a pawl (C) that is normally out of engagement with its ratchet, being retained in this position by its tail, which rests on the tip of the armature (F) of a trip magnet (E). The movement of the sleeve is prevented by this locking action, and further guarded by a spring-loaded lever (H). When the release magnet is energised, its armature releases the tail of the pawl (C), which falls into the wheel and locks the sleeve to the rotating shaft. The sleeve will then make one rotation, after which the tail of the pawl will again fall on the tip of the armature, thus moving it out of engagement with the ratchet and permitting the shaft to resume idling.

By the selective energising of the trip magnets the cams governing the hour, minute and second portions of the phrases can be stepped as required. An eccentric mounted on the sleeve gives a reciprocating motion to the pawls of the cam-ratchets, which are thus stepped one tooth for each rotation of the associated sleeve on the trip spindle. The energising of the trip magnets is also controlled by the driving motor through a small cam barrel, which closes suitable contacts at the correct moment. This system ensures that the scanning units will be opposite the sound-tracks of the correct time phrase at any one moment.

The motor which drives and controls the mechanism is an eight-pole separately excited synchronous machine, and is itself synchronised for timing by a master seconds pendulum (fig. 2). The lower extremity of the pendulum (1) carries a photographic transparency (2). A set of lenses focuses the image of a slit (3) centrally on this transparency when the pendulum is at rest. The form of the transparent areas is such that when the amplitude of the swing of the pendulum is correct the light passing through to the photo-cell (4) will vary sinusoidally, having a frequency of four cycles per second.

The photo-cell feeds a two-stage amplifier (5) and the output from this (when the pendulum is swinging over a correct arc) will be a particular sine-wave. If the arc is too small or too large the wave will alter in form. This variation of wave-form is used to control the impulse given to the pendulum, and consequently to maintain it at a correct value for a constant arc.

The amplifier output is connected with the primary of a transformer (6), one secondary winding of which has a central tapping. By means of two rectifiers (8) and (9) the condensers (10) and (11) receive charges due to the positive and negative current half-cycles, and the difference of potential between them is applied, after smoothing, to a resistance (12). With a correct swing the charges on the two condensers are equal and there is no potential difference between points (13) and (14). This limits the effective bias applied to the grid of the gas-filled relay to that of the battery (16).

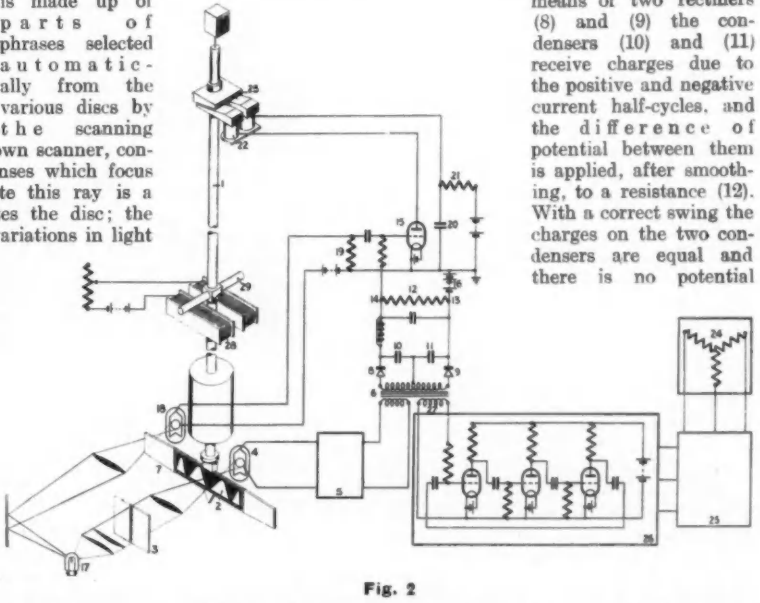


Fig. 2

As the pendulum arc falls the wave-form becomes unsymmetrical, the charges on the condensers become unequal and a difference of potential appears between points (13) and (14), thus reducing the effective negative bias of the gas-filled relay. This reduction is used to control the application of the driving impulse to the pendulum by means of a second photo-cell. A shutter (7) on the pendulum allows a narrow beam of light from the lamp (17) to fall on the photo-cell (18) at the mid-point of each left-to-right swing, and the resulting rise in the photo-electric current momentarily raises the potential of the grid of the gas-filled relay (15). With the correct amplitude of the pendulum this rise is not sufficient to make the relay conductive, but when the arc falls below a certain point the reduction in the effective steady bias caused by the potential difference across the resistance (12) is enough to make the relay conductive at the instant that the impulse from the photo-cell is applied.

The condenser (20) which has been charged through the high resistance (21) then discharges through the windings of the impulse magnet (22), which attracts its armature (23), gives an impulse to the pendulum and restores the arc to normal. The small additional secondary winding (27) of the transformer (6) is used to hold the supply to the driving motor in synchronism with the swinging of the pendulum, the output of this secondary being applied to the grid circuit of one of the valves of the three-phase oscillator (26). This in turn controls the high-power amplifier (25) which supplies the motor, and thus the whole mechanism is kept in synchronism. The Greenwich time signal is used to govern the master pendulum, the clock being checked hourly. If the signal does not find the clock in the correct position relays are operated, and the current in the coils of the magnet (28) is varied accordingly. The attraction of the small armature (29) on the pendulum is correspondingly altered, and, as this imposes a small force on the pendulum in addition to gravity, slight changes of the pendulum rate can be effected by this means.

Provision is made for the simultaneous connection of up to one hundred subscribers, all of whom can receive the time signals at the same moment. The clock will be erected at the "tandem" exchange, Holborn. It will, however, be entirely separate and will really form an additional "exchange" devoted solely to time distribution. Similar clocks are to be installed at Bristol and Manchester, and later the service may be extended to a number of other big provincial centres.

The illustrations are published by courtesy of the Post Office Engineering Department.

Tests of Circuit-breakers on Networks

WITH the co-operation of the North-Eastern Electric Supply Co., Ltd., a series of tests was made at the Reyrolle short-circuit testing station on March 21st, when a number of short-circuits were switched on to the supply company's 5,500-V network under normal running conditions for the purpose of obtaining data on the characteristics of restriking voltage and on the severities under which circuit-breakers operate in service.

The sub-station at the testing station was typical of "Nesco" conditions in available fault-kVA and supply connections, and the comprehensive testing and recording facilities at the testing station enabled the test to be made expeditiously. Oscillograms were obtained both with the cathode-ray equipment of the testing station and also with a portable six-element cathode-ray equipment provided by the Electrical Research Association, which assisted at the tests.

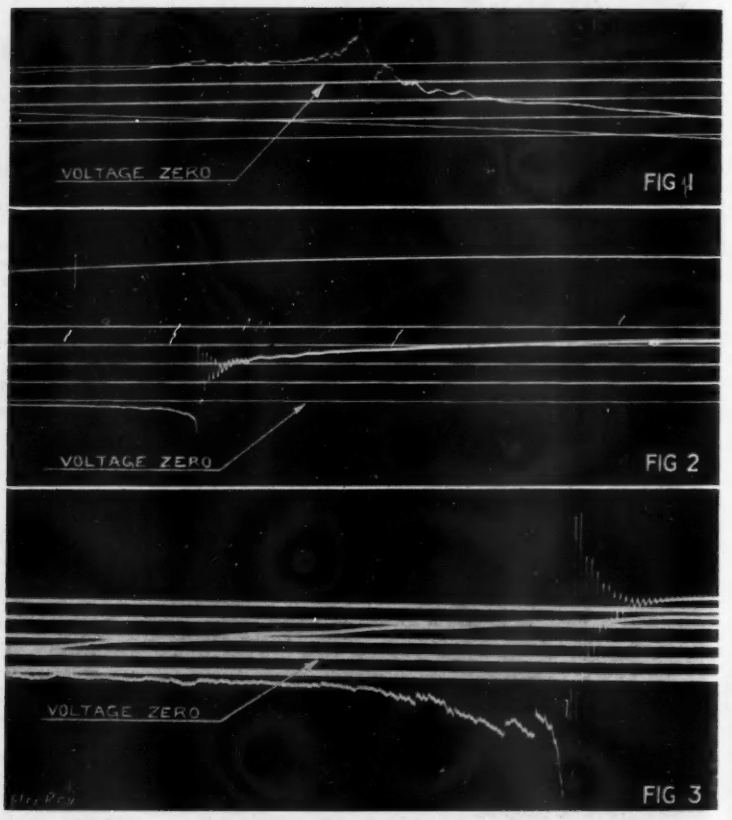
Tests were first made with the vicinity short-circuit current reduced by reactors, and oscillograms characteristic of the high rates of rise of restriking voltage appertaining to testing stations were obtained. Further tests without reactors, and therefore with the maximum vicinity short-circuit current, gave oscillograms indicating lower rates of rise of restriking voltage, so proving that easements may be expected to vary in amount with rearrangements of supply networks.

Preliminary analysis of the cathode-ray oscillograms reproduced indicates that the rates of rise of restriking voltage, measured in accordance with the tentative British suggestions (Specification Draft "B") submitted by the British National Committee to the I.E.C. meeting at Prague in 1934, are 7, 800, and 2,400 V per micro-second for figs. 1, 2 and 3, at the instant of the clearing of the short-circuit.

The oscillograms do not show the inherent rates of rise of the circuits themselves, and to obtain these the values given above must be amended because the circuit-breaker used affects the rate of rise measured at the conclusion of its operation. At the time of writing, the final analysis had not been made, but preliminary inspection indicates that for the tests under discussion the value obtained from fig. 1 will be considerably increased, and that from fig. 3 considerably reduced.

The tests covered a range of varying restriking voltage conditions comparable with those met with in service, and afford evidence in support of the practice of type-testing circuit-breakers with suitably high rates of rise of restriking voltage at testing stations, since this ensures both that the worst conditions will be successfully met and that there will be a greater margin at points of lower rates of rise.

The tests, which were at about 75,000 kVA, produced no disturbance on the network other than momentary flicker of lamps, indicating the stability obtained with high-speed unit protection. The tests were made with a Reyrolle standard plain-break circuit-breaker of the type used in the sub-station, and also with a special circuit-breaker fitted with turbulator contacts with the object of minimising the influence of post-arc conductivity on the natural oscillatory and damping characteristics of the network. This test data obtained will be used as a basis for further research on the range of rates of rise of restriking voltage to be found at various points on a supply system.



Oscillograms of the Tests

Fig. 1.—Network conditions at maximum vicinity short-circuit current; network volts, 5,500; power factor, 0.65 lagging; symmetrical breaking current, 7,500 A, r.m.s. **Fig. 2.**—Network conditions, with vicinity short-circuit current limited to two-thirds of the maximum; network volts, 5,500; power factor, 0.15 lagging; symmetrical breaking current, 5,000 A, r.m.s. **Fig. 3.**—Testing-station conditions, with short-circuit current limited to value associated with Fig. 1; applied volts, 5,780; power factor, 0.10 lagging; symmetrical breaking current, 7,500 A, r.m.s.

Meetings and Discussions

Special Types of Transformer and Stroboscope

TWO papers were considered at a meeting of the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 3rd. The first, by Messrs. J. G. WELLINGS, J. R. MORTLOCK and P. MATTHEWS (of the B.T.H. Co., Ltd.) describes in a general way that class of apparatus which the authors propose should be termed the "capacity voltage transformer," as distinct from the conventional type. It operates as a compensated capacitor divider, essentially without recourse to electromagnetic coupling, but nevertheless functioning with the same characteristics as an electromagnetic voltage transformer, in that accuracy of secondary voltage is maintained with variation in secondary burden. The capacitor voltage transformer must, therefore, not be confused with the straight-connected capacitor divider, in which accuracy is only obtained under no-load conditions, the ratio and phase errors becoming excessive when load current is taken from the tapping point.

No claim is made that new principles of design are presented, the main purpose of the paper being to establish a wider understanding of this class of transformer with a view to the extension of its field of application. A mathematical treatise on the theory of the device is included. The principal applications of the transformer have been in connection with synchronising and relay operation. The authors feel, however, that the ability to control ratio and phase-angle separately, as explained in their paper, should permit the use of this apparatus to be extended to metering equipments, to signal and inspection lamps, and possibly air-way beacons or pylons; also to local lighting of outdoor sub-stations where no other source of supply is available, to the operation of oil-testing sets, and battery charging through some form of rectifier.

In all such cases supplies of power may be obtained without the installation of switchgear and, in general, without introducing any additional hazard to the system. At the same time, all working parts are accessible in perfect safety.

The second short paper, by Mr. R. S. J. SPILSBURY, describes a stroboscope that has been developed at the National Physical Laboratory for frequency measurement. It employs a thyratron valve and demands only 0.6 VA at 230 V from the source of standard frequency (*i.e.*, a tuning-fork generator in this particular case).

The effective length of each light flash, obtained from two neon tubes, is approximately 50 microseconds. As a guide to the possibilities of the device for observing moving parts it may be mentioned that it is easily possible to read type (about the size of that employed in this journal) when mounted at a radius of 2 in. on a disc rotating at 3,000 r.p.m. If the light given by the neon tubes is insufficient the output voltage should be suitable for controlling a grid-type mercury discharge-lamp fed by a second condenser-resistor circuit.

* * *

What is the Best Tariff?

THE papers on tariffs, by Mr. B. Handley, and prices, by Prof. Miles Walker (to which reference was made last week), were discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 2nd. The opening speaker, Mr. W. FENNELL, said that most shops had no diversity and closed before dark in summer, so the maximum demand system was applicable to them. Private houses were different, and the m.d. system could not be represented by any other present method of charge. The rateable value system penalised some classes of premises, such as flats, which were rated much higher than equivalent suburban houses. There was only one method of charging for domestic supplies, but it could not be employed because householders would not tolerate discrimination between different types of consuming apparatus. Special-purpose meters were too expensive; if they could be mass-produced and their price reduced nearer to that of the plain kWh meter an enormous harvest would be reaped. The Electricity Commissioners should implement their recommendations and choose one tariff for general use. The industry could not go on devising new tariffs.

When the change of ownership at Oxford took place the old company was at the end of its tenure. How much would the author be prepared to expend upon the modernisation of his own house within a few months of the end of his lease? Not one of the author's sample charges was below ¾d. per kWh, whereas many undertakings offered ½d. or less. The vehicle battery-charging scheme seemed to provide for everything except a suitable battery. The public would not tolerate load limiters.

Capt. J. M. DONALDSON considered Mr. Handley's opinions to be sound. The fixed portion of a two-part tariff should enable the consumer to obtain his lighting at the same cost as on the flat rate, so that all energy consumed beyond that amount would be charged for at the low follow-on rate. It was impossible to base the fixed charge on the wattage installed. The floor area, obtained by outside measurement, was an easier method, and it overcame most difficulties. It enabled "hard cases" to be re-estimated after a trial period, especially in the case of country houses containing rooms which were infrequently used.

Mr. J. W. J. TOWNLEY found considerable disagreement between the two papers. Mr. Handley had expressed views with which most supply engineers would agree. To base the fixed charge on floor area was not a perfect method, but it was acceptable in the majority of cases. If the two-part tariff could be made statutory, then the desired result would be achieved and the flat rate would disappear. He quoted figures to indicate how the equated "all-in" penny rate had attracted many cooker users at West Ham. Though there were objections to it, it was a means of getting consumers on to the two-part tariff, and 75 per cent. of the people in this country were of the same class as those in West Ham. Mr. Townley said he disagreed with many points in Prof. Walker's paper. The grid had not reduced prices everywhere, and it could not do so. One should encourage diverse use of a variety of apparatus rather than worry about the peak-cooking load, which should not be restricted. Load limiters were not liked, except for water heaters, and only in that case because users did not usually know whether they were "on" or "off."

Mr. W. A. TURNBULL explained how he had allocated costs at Aylesbury in order to base charges on them, taking into account the domestic, business and power demands. Business premises should have a demand indicator, read officially once a year at the end of the peak-load quarter, equal amounts only being charged. Private houses should have a standing charge based half on rateable value and half on outside base area, avoiding inside measurement of rooms. Consumers of l.v. power should have a flat rate and h.v. consumers a kVA plus kWh rate. The business and domestic kWh price should be ¾d. Water heating could be done at, say, ½d. per kWh after the cooker allowance according to the standing charge (say, 750 kWh for a rateable value of £40) had been used. Farm-houses were low rated, and with a r.v. component would give satisfaction. The lighting of outbuildings could be dealt with by an addition to the standing charge according to the estimated demand. The several tariffs mentioned needed one meter only per consumer. By taking on sparsely populated rural areas profits would enable reductions to be made in town prices, which would not otherwise be possible. He agreed with Prof. Walker regarding the desirability of encouraging battery vehicles and the "socialisation" of distribution.

Mr. O. HOWARTH remarked that rateable value might be an indication of ability, but not of willingness, to pay a fixed charge. Load limiting would not encourage a more liberal use of electricity, since electricity supply was not a monopoly in the same sense as water was. Tenants of "council" houses, which were let at 9s. per week inclusive, could not afford to pay £4 per year fixed charge. If prepayment meters were installed they must collect all the moneys due to the undertaking. The two-part tariff should not be restricted to users of electricity for purposes other than lighting, otherwise simple lighting consumers would not trouble to employ other appliances.

Mr. D. J. BOLTON pointed out the importance of differentiating between individual and system load factors, and controverted the statement that the use of m.d. meters would improve the load factor. They provided no guide to peak responsibility, and the real question was the aggregate effect on the system. Two consumers, one with a peak in the morning and the other with an afternoon peak, would pay more on the m.d. system than the equivalent single consumer with two similar peaks. Efforts should be made to give each consumer the benefit of the aggregate effect of combined loads.

Some New Instruments
Tariffs and Prices
"Human" Electricity

Mr. A. Cunnington, speaking as a consumer, pleaded for simplicity of tariffs and avoidance of extra metering or allied apparatus. Small shops and bookstalls, such as those at railway stations, wanted electric light, but were not encouraged to combine electric heating with the lighting load, as present methods of charging scared them. The m.d. of small long-hour installations of this kind could easily be assessed, but supply authorities were not always ready to make such assessments. Mr. W. C. P. Tapper thought the papers opportune just now when a Government Committee was considering the subject, since the tariff epidemic showed little sign of abating. Standardisation would never come about voluntarily. The Electricity Commissioners would have to choose one form of tariff for statutory enforcement. The amalgamation of smaller distributors with the larger would enable the smaller to supply at below the statutory maximum.

Major R. Amberton suggested that where particular tariffs had been successful others would probably have produced equal results provided the ultimate price was the same. Simplicity should be aimed at without limiting the addition of apparatus. Mr. W. A. Ritchie said he had found it dangerous to talk of wattage. He had adopted the terms "recorded watts," *i.e.*, amperes multiplied by the declared voltage. Mr. A. N. D. Kerr considered that a two-part tariff should encourage consumers and it was a mistake to stipulate the installation of a cooker. The rateable value method of assessment was understood by all householders, but the floor area method was not by any means so easily appreciated as might be assumed. A paper that was read some time ago, showing what was being done in New Zealand, merited more attention than it seemed to have received.

Mr. C. R. Westlake explained how he had fixed rates in Northern Ireland. The kWh charge must not be more than ½d. if development was to be made. Nevertheless, a variety of tariffs was still necessary and when devising them the economic value of the service offered should be taken into account.

Miss C. Haslett expressed her delight at finding the I.E.E. discussing what she considered to be *the* most important subject. It was very difficult to talk nationally when tariffs varied so greatly.

Prof. Miles Walker, in reply, said the papers had received fair criticism. He did not advocate restriction of use, but load limiters combined with a special switch (with two meters and two rates) for simultaneous use. Mr. B. Handley, also in reply, said he had found two-part tariff meters useful; he used several thousands of them and he had not had many grumbles from people (after being temporarily away from home) having to insert several shillings to cover the standing charge before the supply was restored. People who used that type of meter did not have frequent holidays. He had also used the penny equated rate, but consumers soon tired of it and went over to the ordinary two-part tariff. He agreed that individual consumers and conditions did not matter, as tariffs and revenue should be based on classes of consumers as a whole.

Mr. Theodore Stevens has sent us a copy of his contribution to the discussion (in writing for the I.E.E. *Journal*) in which he points out that Prof. Walker's Herne Bay sample cost should be lower than the figure quoted in the paper. Mr. Stevens regrets that so little appreciation of the consumer's point of view is shown by many responsible for supplying electricity.

* * *

Electrical Phenomena of the Human Body

Electrical effects connected with the human body are discussed in the paper by Mr. W. F. Floyd and Dr. C. A. Keele, M.R.C.P., which was read before the London Students' Section of the Institution of Electrical Engineers on April 7th. The authors point out that all living cells and tissues exhibit electrical phenomena; potentials may be recorded from them and electrical conduction demonstrated. It is important to distinguish between these two phenomena. Potentials observed in a living organism may be regarded as normal concomitants of its metabolism or activity, whereas conduction only occurs in the abnormal state produced when the organism is connected to a closed circuit. Nevertheless, conduction is also related to the metabolism or activity of the organism, but, in general, the relation is more complex than in the case of potential phenomena. These electrical properties are inherent in the physico-chemical structure of the living cell, and observations of them reveal certain important facts about the physico-chemical structure of the organism. Certain effects are observed when contact is made only with the external surface of the skin; these may be (1) electrical states of the body tissues under natural conditions and (2) bodily responses to electrical stimulation arising from without the body. Group (1) includes the electrical impulses arising from the heart and from muscular activity, and the potential phenomena recorded by the authors from the skin. Group (2) includes nerve and muscle stimulation (faradic and galvanic stimulation employed by the electro-therapeutist), high-frequency excitation of tissue, and direct-current and alternating-current conduction phenomena. The paper gives a brief summary of the types of circuits used by various investigators for observing and recording these phenomena, and the conditions of use are analysed. The authors' work on skin potentials and conduction is treated in detail, the relations between electrode area, current value, skin temperature, and the observed electrical properties are discussed.

* * *

Marine Boilers

Among the several papers presented at the spring meeting of the Institute of Naval Architects in London was a paper by Mr. C. E. Sherwin (student) on "Electric Welding in Cruiser Construction." Two others of interest to power station engineers were the review by Eng. Rear-Admiral W. M. Whayman of the present position of marine boilers as used on large high-speed ships burning oil fuel, and a paper by Eng.-Capt. S. R. Dight describing the results of tests and experiments made with Naval water-tube boilers at the Admiralty Fuel Experimental Station, Haslar. Both authors conclude that forced steam and water circulation, permitting higher rates of evaporation, will be the trend of the future.

* * *

Are Domestic Appliances Adequate ?

At a recent meeting of the London Students' Section of the Institution of Electrical Engineers, Mr. P. H. Pettifor opened an informal discussion on "Are Present Day Domestic Electrical Appliances Adequate?" He remarked that common faults of all rotary machines were quick brush wear-out, breakdown of windings, and creation of excessive noise. Under this heading might also be included supply meters, the mechanism of which, especially of the prepayment types, fell short of the desideratum. Nearly all stationary electrical appliances had been considerably improved during the last few years as regarded finish, electrical design and reliability, but most of the items still fell far short of the ideal as regarded maintenance and safety in use. Switches were noisy and difficult to wire; lamp-holders and ceiling roses were fitted with absurdly small connectors; lighting fittings seldom combined good appearance with ease of wiring; wireless sets still broke down in a component which necessitated dismantling nearly the complete set to effect a repair. One common fault which nearly all heating apparatus had was that fine control of the temperature was impossible, or, if it was provided, the additional equipment was so expensive and elaborate that the advantages to be gained from fine control were completely offset. While it was difficult not to agree that so long as electrical appliances were in working order they did their allotted jobs effectively, yet the design of most apparatus was such that it had to be more or less dismantled to effect the smallest repair, such as renewing a brush, cleaning a dirty contact, or fitting a length of new flex.

* * *

Chlorinated Rubber

Dr. J. P. Baxter, of I.C.I. (General Chemicals), Ltd., Widnes, read a paper on "Some Properties of Chlorinated Rubber" to members of the Liverpool Section of the Society of Chemical Industry recently in which he said that chlorinated rubber was a good electrical insulating material and might possibly find application in the industry. The mechanical properties of non-plasticised chlorinated rubber, however, were somewhat unsatisfactory as the film itself was brittle, but, in combination with a suitable plasticiser, films of good mechanical and electrical properties could be obtained. The chemical claims of chlorinated rubber for consideration in the electrical industry were its thermoplastic and non-inflammable nature and its resistance to water, alkali, acids and petroleum oils.

* * *

Testing Mining Plant

A paper on the maintenance and testing of electrical plant was read by Mr. H. C. Davies at a recent meeting of the South Wales branch of the Association of Mining Electrical Engineers. Mr. Davies stressed the importance of key plans in connection with any investigation, and said it was desirable that maintenance engineers should follow a recognised programme in the general care of generating equipment. Mr. H. Williams (branch president) occupied the chair, and in the course of the meeting extended a welcome to Mr. C. C. Bleech who, during his year of office as president of the Yorkshire branch of the Association, has been transferred to a post in South Wales.

* * *

Plant Erection

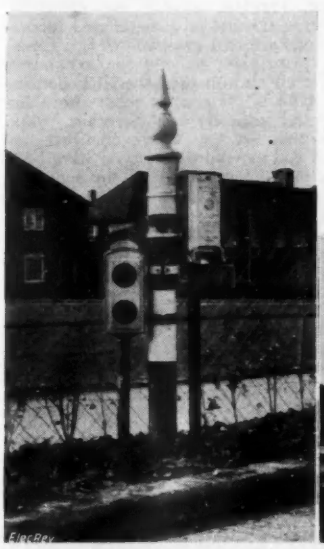
An instructive lecture was delivered before the Stafford Works Engineering Society of the English Electric Co., Ltd., a week or two ago by Mr. A. B. Barnacle, superintendent of the Company's Erection Department. The lecturer took "Erection Work in the Field" as his subject, and presented it in such a form as to appeal to the younger element in his audience for consideration as a career. Special reference was made to the use of photographs as a means of reporting progress and, at the same time, providing useful records for guidance in future contracts.

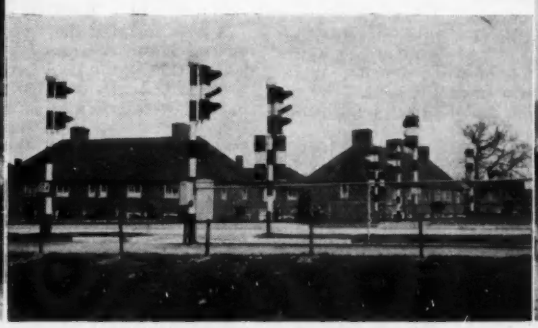
Light-ray Road Signals

Details of a novel system of pedestrian and traffic control on the Sutton by-pass road

THE system of coloured light signals which was inaugurated by the Minister of Transport last week on the Sutton by-pass road (St. Helier Avenue) at Morden is said to be the first of its kind, at least in this country. The traffic control signals are actuated by beams of light impinging on photo-electric cells, instead of the more usual vehicle-actuated road pads or push-buttons for the use of pedestrians. This experimental installation has cost £660 and the annual cost of maintenance for the single crossing will probably be about £50. The site of the installation is a reconstructed road 80 ft. wide, comprising two 20-ft. carriageways, two 6-ft. cycle tracks, and two 8-ft. footpaths, with dividing strips and verges between them. The road runs through an L.C.C. housing estate and the signals have been provided by the Surrey County Council primarily for the protection of pedestrians, though they can be employed for vehicular traffic control.

An essential requirement for this type of automatically controlled crossing is that the footpaths shall be fenced for at least 100 yards on each side of the crossing, so as to lead pedestrians through the gap and break a beam of light. This ray is provided by a low-voltage automobile type filament lamp in a metal box about 3 ft. above ground level. It is focused on a photo-electric cell receptor opposite, with which are associated relays that send impulses to the master controller that changes the signals as required.





Left: Ray transmitter for vehicles. Centre: View of crossing. Right: A pedestrian breaking the dual ray at the road centre

When the barrier ray is interrupted by the passage of a pedestrian the relays register his demand to cross and (if no vehicles are approaching) he receives the "Cross Now" signal at once. If vehicles are also registering demands (by interrupting other light rays further along the road) the signals remain at "Don't Cross" until a sufficiently long space appears between vehicles to give the pedestrian time to cross safely. Alternatively, should the vehicle stream be continuous, the pedestrian obtains his right of way after a time interval, which can be pre-determined on the master controller.

The duration of the pedestrian signal is fixed, but that of the road is extensible up to a maximum green period by the demands of approaching vehicles.

For the detection of vehicles there are separate rays for the up and down roads about 50 yd. from the crossing. They shine diagonally across the carriageways, the transmitters being at the roadsides and the receptors on the dividing strip at the road centre. A diagonal ray was chosen to ensure that slower moving traffic, which will be nearer the outside edge of the road, is detected nearer to the crossing and automatically given more time to traverse the crossing.

Two ray lamps are fitted to the vehicle transmitters, the second coming into action automatically if the first should not function. Failure of a lamp also causes a red signal lamp to be displayed on the outside of the controller pillar, thus giving warning of a defect. The lamps in the vehicle transmitters are fitted with infra-red screens which prevent any visible beams from falling on the eyes of approaching drivers.

The signal post indications are of the normal three-aspect (red, amber and green) form, while those for pedestrians have red and white lenses. In addition to the two-aspect signals which are fitted at normal height, four sets are also fitted at eye level, the indication being thus impressed upon the pedestrians in a very definite manner.

Two additional pedestrian rays at the road centre can be used either for discrimination of the direction of the pedestrians' movements, or to allow them to cross one carriageway while the other is still busy, halting at the centre until the other road is clear and releasing the traffic behind.

The photo-electric cells are of the cæsium type. Quite a small interruption of the ray causes a very definite trip of the relay. The pedestrian receptor windows are guarded by screens, and the traffic ray transmitters are at the road edges, while the receptors are at the centre in order to prevent car headlamps from shining on the photo-cells.

The system has been constructed and erected by the Automatic Electric Co., Ltd.

The E.I.B.A. Luncheon

THE annual luncheon of the Electrical Industries Benevolent Association followed the annual general meeting at the Savoy Hotel on April 3rd. Viscount Falmouth, president, occupied the chair, and, after the loyal toast, called upon Mr. J. M. Kennedy, president, I.E.E., to propose the toast of "The Association."

In doing so, Mr. Kennedy remarked that the various branches of the electrical industry now employed not less than one million people. That was a larger figure than ever before, in spite of the depression through which we had passed, and it showed that the establishment of the grid had had a beneficial effect; at least, it could not have had an adverse effect. He was a confirmed optimist so far as the future was concerned. The capital invested in the manufacturing industry was increasing at the rate of £30 millions per year, and no one could doubt that it was remunerative.

But, in spite of such progress, little provision was being made for those who fell by the way. Such provision as was being made was totally inadequate for the needs of to-day and next year, quite apart from what might be required in the future. In prosperous times it was difficult to realise that there was a burden of need for which proper provision was not being made. He hoped that all would do that "little extra" which was so badly needed.

In reply, Viscount Falmouth welcomed those ladies and gentlemen who, by their presence, had shown their interest in the Association, whose aims he hoped they would further. The Association had been overhauled, and far more drive and incentive added to the movement. A summer cruise had been arranged which would be of financial benefit to the Association, and they were all indebted to Mr. E. E. Sharp, chairman of the Executive Committee, for his work.

The electrical industry was the greatest industry in the country; it had accepted great responsibility, and over £1,000 millions was invested in it. But what was it doing for those in need? Last year a mere £7,000 was collected. The industry was not unprofitable, and its future was unbounded. Surely it ought to do more! Other similar funds within the industry were all necessarily selective and sectional. The E.I.B.A. was the only organisation that could, and did, deal with every section of the industry, which, in its corporate capacity, had a duty towards those who fell upon evil times.

D

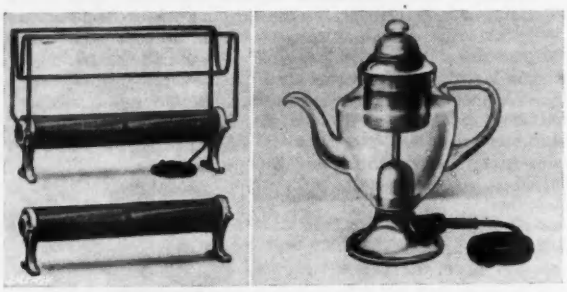
New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Bulpitt Domestic Appliances

Among recent developments in the domestic field by Messrs. Bulpitt & Sons, Ltd., Swansea Works, Birmingham, 1, is a small cylindrical heater with a towel dryer attachment. It can be used either as a floor model or screwed to the wall, the attachment being suitable for towels, gloves and small articles of clothing. The finish is ivory enamel and the two sizes, 1 ft. and 2 ft. long, have loadings of 200 and 400 W respectively.

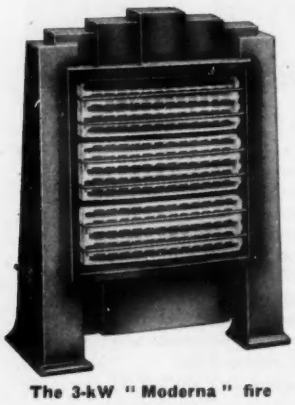
Another new appliance is a glass coffee percolator heated by a standard "Swan" immersion type element. The connector, to which is attached two yards of three-core cable, is fitted into the base of the percolator. A useful attachment which can be obtained to fit on top of the percolator is a milk warmer which utilises the steam from the coffee. This has a capacity of ½ pint, and, like the metal parts of the percolator itself, is chromium plated.



The "Swan" glass coffee percolator (on the right) with milk-warming attachment, and the cylindrical heater with and without drying attachment

A 3-kW "Moderna" Fire

We are informed by the Revo Electric Co., Ltd., Tipton, Staffs, that a new 3 kW model "Moderna" fire has been introduced. It is designed on exactly the same lines as the smaller sizes, but the whole range is now available in a variety of finishes, including sprayed shaded green, blue, beige, brown or pink; plain or rainbow vitreous enamel; and brown, green or beige majolica enamel.



The 3-kW "Moderna" fire

Large-capacity Batteries

"Exide Hycap" batteries are a new product of the Chloride Electrical Storage Co., Ltd., 137, Victoria Street, London, S.W.1. They differ from the "mass" type in that they have more plates and are capable of giving a greater discharge current: they can also be charged more rapidly. The cells are rated at 2 V and are available with capacities of 15, 24, 36 and 60 Ah at the twenty-hour rate.

Suppressorless Car Radio

A radio receiving set for use in motor cars, made by Philips' Lamps, Ltd., 145, Charing Cross Road, London, W.C.2, dispenses with the need for fitting spark suppressors to the car's ignition system, which are apt to detract from the engine's performance. Seven valves, including rectifier, provide seven tuned circuits with a h.f. pre-selection stage and two i.f. band-pass filters. The wave ranges are 210 to 550 and 800 to 1,950 metres. The current rating is 3 A at 12 V, which is derived from the car battery, while 7.5-W anode dissipation gives 3-W undistorted output. Automatic volume control is provided, and the tuning is silent, the p.m. loud speaker also having a tone control. The under-car aerial is easy to install and is of the tuned type, so that it acts as a wave trap for frequencies at which engine interference occurs. Flexible supports enable the aerial to be mounted low down and yet swing away from road obstructions.

The set can be installed without special instruction and is smaller than the previous model. It is 10.5 in. long, the case being 1.5 in. shorter and in addition 3 in. has been saved on each side by dispensing with the space necessary for tightening the nuts, by which the set was previously fixed. All cables are connected by means of external screw-on unions, and it is stated that it is possible for the whole instrument to be installed on its bracket and connected up within five minutes.

The aerial filter which previously was fitted outside the set has now been reduced to a fraction of the original size and is inside the set, thus saving further space and also fitting time. The control box is constructed of black polished bakelite with chromium-plated fittings. Two knobs of generous size are the only controls necessary; only one wave band is visible at a time, each band having its own distinctive colour, and being illuminated by a coloured pilot lamp behind the dial.

A key is provided to lock the set in the "off" position. The control box is available for mounting in the dash, under the dash, or on the steering column.

Fixing "Rawlbolts"

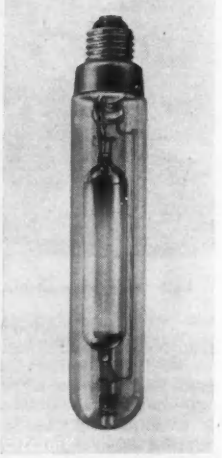
Since the "Rawlbolt" was introduced by the Rawlplug Co., Ltd., Cromwell Road, London, S.W.7, improvements have been introduced involving the use of a castellated ferrule and a claw segment. The bolts are still available in two types, both embodying the same principles; on one the expanding member is part of the bolt itself and on the other it is detachable. The bolt projecting type is for use on jobs where the shell and bolt can be inserted into the hole together, while the loose bolt type is designed for use where the bolt has to be inserted after the shell and expanding member have been placed in position. The extended leg portion of the segment, acting as a claw, prevents the nut from becoming loose.

Electric Discharge Lamps

A new model of the "Osira" discharge lamp is announced by the General Electric Co., Ltd., Kingsway, W.C.2. It is of 150 W rating for 200 to 260 V a.c. circuits. It has a screw cap and, like its predecessors, gives nearly three times the light output of a tungsten lamp of equal wattage. It can thus replace the latter for special lighting purposes, particularly where only low mounting is available.

The new lamp can be mounted 10 ft. above the working plane and its initial lumen output is 4,800 (32 per watt) compared with the 1,950 of a 150-W tungsten lamp. Fittings for accommodating the new lamp are also offered, in dispersive parabolic and distributive types for both indoor and exterior use. A series choke and a condenser for power-factor correction are necessary.

Discharge lamps of this size have also been introduced by the British Thomson-Houston Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., the overall length being 230 mm. and the outer tube diameter 43 mm.



The 150-W "Osira" discharge lamp

The "Britrae" discharge lamp

The first "non-ring" discharge lamp to make its appearance in this country is announced by Briton Lamps, Ltd., Roman Wall House, Crutched Friars, London, E.C.3.

It is of the mercury-vapour type and is designed to operate on a.c. circuits only at from 200 to 250 V, and has been subjected to a life test of 1,020 hours without failing.

A suitable choke in series with the lamp is essential, while for power-factor correction a condenser should be used as well. These auxiliaries can be provided if necessary, but no attempt is to be made to supply lanterns for the lamp or complete lighting fittings.

The luminous spectrum of the new lamp is said to be a little improved in so far as it is claimed to contain less ultra-violet rays and so to be a slightly nearer approach to natural light.

The lamp is made at a works near London, 250-W and 400-W ratings being obtainable. The smaller model is 250 mm. and the larger one 320 mm. long, the diameter being 46 mm. in both cases. At 230 V the approximate starting currents are 4 and 5.5 A without and 3 and 4 A with a condenser, the respective running currents being 2 and 3.2 A without and 1.3 and 2.2 A with a condenser. The light output efficiencies are said to be 37 and 43 lumens per watt respectively. We are informed that 150, 100 and 75-W sizes are to be introduced by the manufacturers at a future date.

Electrical Imports of Australia

THE annual statement of the overseas trade of Australia for 1934-35, just issued, gives a detailed classification of the imports of electrical goods, the principal items of which, together with the countries of supply, are shown below. Increases or decreases compared with 1933-34 are added. It will be seen that business showed a further recovery in all the important groups, and especially in cable and wire and telephone and radio material. The electrical import trade is, however, far below the level of five or six years ago, even allowing for the fall in prices. In 1928-29 its total value was £6,127,000; in 1929-30, £6,101,000; 1930-31, £2,842,000; 1931-32, £1,201,000; 1932-33, £1,422,000; 1933-34, £1,635,000; and 1934-35, £2,493,000. Later (uncorrected) figures show that for the latter half of 1935 the value of imports was £1,664,000.

	1934–35. £	Inc. or dec. on 1933–34. £
Dry cells—		
Total	3,100	+ 1,500
From United Kingdom	1,200	+ 500
„ United States	1,800	+ 1,000
Storage batteries for radio sets—		
Total	280	+ 180
Storage batteries for motor vehicles—		
Total	6,100	+ 2,600
From United Kingdom	1,500	+ 400
„ United States	4,400	+ 2,000
Other batteries and parts—		
Total	14,000	—
From United Kingdom	8,000	+ 3,000
„ United States	6,000	− 4,500
Cable and wire (cotton covered)—		
Total	11,000	+ 3,700
Paper-insulated, lead-covered telegraph and telephone cable—		
Total	11,400	+ 9,700
From United Kingdom	5,500	+ 5,000
„ Belgium	2,500	+ 2,400
„ Germany	1,800	+ 1,800
Other telegraph and telephone cable—		
Total	10,300	− 3,000
From United Kingdom	6,700	− 3,300
„ Germany	3,400	+ 400
Paper—insulated, lead-covered, light and power cable—		
*Total	23,000	+ 2,000
Other cable and wire—		
Total	590,000	+ 178,000
From United Kingdom	522,000	+ 174,000
„ United States	24,000	− 3,000
„ Germany	13,000	+ 3,300
„ Canada	7,000	+ 3,000
„ Japan	8,300	+ 4,600
Carbon manufactures—		
Total	55,000	+ 9,000
From United Kingdom	21,000	+ 2,000
„ United States	16,000	+ 5,000
„ Germany	12,000	− 1,000
„ France	2,700	+ 700
Motors under 1 h.p. (separate)—		
Total	48,500	+ 16,500
From United Kingdom	23,000	+ 3,000
„ United States	19,000	+ 9,500
„ Germany	2,800	+ 1,600
H.V. induction coils—		
Total	16,400	− 4,600
From United Kingdom	3,900	− 3,300
„ Canada	3,200	− 1,600
„ United States	9,300	+ 500
Electric fans—		
Total	13,100	+ 6,800
From United Kingdom	4,000	+ 1,500
„ Italy	5,200	+ 1,800
„ United States	3,500	+ 3,100

	1934–35. £	Inc. or dec. on 1933–34. £
A.C. induction dynamos—		
Total	73,000	+ 30,000
From United Kingdom	49,000	+ 21,000
„ United States	11,800	+ 3,300
„ Sweden	8,600	+ 4,400
A.C. variable speed commutator type dynamos—		
*Total	8,100	+ 5,700
Other A.C. dynamos—		
*Total	43,400	+ 11,400
D.C. traction motors—		
*Total	1,700	+ 200
Other D.C. dynamo-electric machines—		
Total	68,000	− 16,000
From United Kingdom	41,000	− 30,800
„ Germany	12,000	+ 7,300
„ United States	10,600	+ 4,600
Dynamo-elec. machines, n.e.i.—		
Total	23,000	+ 800
From United Kingdom	13,300	+ 3,300
„ United States	6,200	+ 3,200
Motor and rotary converters—		
Total	2,700	− 600
Motor-car filament lamps—		
Total	62,000	+ 31,000
From United Kingdom	18,100	+ 7,900
„ Japan	1,500	− 1,400
„ Holland	37,700	+ 20,100
„ United States	4,600	+ 4,100
Lamps under 20 V, including torch and flashlight—		
Total	25,000	+ 12,800
From United Kingdom	10,800	+ 3,500
„ Japan	2,600	+ 600
„ Holland	7,200	+ 5,900
Lamps, 20 V and over, gasfilled—		
Total	75,000	+ 27,000
From United Kingdom	65,700	+ 24,600
„ Holland	5,000	+ 2,300
Other lamps, 20 V and over—		
Total	42,000	+ 5,000
From United Kingdom	31,000	+ 8,000
„ Japan	8,100	− 1,900
Fittings and accessories—		
Total	38,000	+ 14,000
From United Kingdom	23,000	+ 11,000
„ Germany	1,800	− 900
„ Japan	5,700	+ 800
„ United States	5,300	+ 300
Switches, fuses, cut-outs, etc.—		
Total	61,000	− 4,000
From United Kingdom	29,000	− 12,000
„ Germany	2,400	− 5,200
„ United States	18,100	+ 5,700
Heating, cooking and domestic appliances—		
Total	16,000	+ 7,200
From United Kingdom	6,800	+ 3,900
„ United States	2,200	− 800
„ Canada	6,900	+ 4,400

	1934–35. £	Inc. or dec. on 1933–34. £
Floor polishers and hair dryers—		
Total	10,900	+ 700
Measuring and recording instruments—		
Total	89,000	+ 39,000
From United Kingdom	47,000	+ 12,000
„ Switzerland	11,000	+ 5,000
„ Germany	9,100	+ 5,100
„ United States	18,400	+ 6,200
Regulating and controlling apparatus—		
Total	63,000	+ 9,900
From United Kingdom	36,000	+ 3,000
„ United States	24,000	+ 8,700
Static transformers, 66,000 V and under—		
Total	7,100	+ 4,000
From United Kingdom	3,400	+ 2,100
„ United States	2,300	+ 1,200
Static transformers, over 66,000 V—		
*Total	10,000	+ 10,000
Telegraph instruments and appliances—		
*Total	14,500	+ 6,800
Telephones—		
*Total	51,500	+ 8,500
Telephone switchboards and appliances—		
Total	153,000	+ 82,000
From United Kingdom	135,000	+ 69,000
„ Belgium	1,000	+ 500
„ Sweden	6,500	+ 5,800
„ United States	5,600	+ 2,500
Electrical vacuum tubes—		
Total	7,600	− 4,900
From United Kingdom	1,800	− 1,300
„ Holland	1,800	− 1,900
„ United States	3,700	− 1,800
Radio valves—		
Total	327,000	+ 136,000
From United Kingdom	117,000	+ 68,000
„ Holland	68,000	+ 56,000
„ United States	135,000	+ 10,000
Radio receiving sets, accessories and parts—		
Total	80,000	+ 26,000
From United Kingdom	26,400	+ 10,400
„ Holland	3,400	+ 2,900
„ United States	45,000	+ 13,000
Electrical appliances n.e.i.—		
Total	156,000	+ 34,000
From United Kingdom	88,000	+ 27,000
„ Canada	1,400	+ 1,500
„ Germany	4,400	− 3,000
„ United States	52,700	+ 10,700
„ Japan	4,500	− 1,500

* Mainly from the United Kingdom.

The National Register

IN our last issue we reviewed the 1935 report of the National Register of Electrical Installation Contractors. This was presented and adopted at the annual meeting held at the Institution of Electrical Engineers on Friday last. Mr. P. V. Hunter, the chairman of the Executive Committee, presided.

The accounts for the year ended December 31st last show that the total income was £4,538 (against £4,574 in 1934). New certificates provided £677 (against £800), and renewal fees amounted to £3,576 (against £3,490); income from investments remained stationary at £237. The expenditure totalled £3,826 (against £3,384), leaving a surplus of £711 (£1,190). The increase in expenditure was mainly due to higher inspection expenses, although office expenses and income tax also rose.

Mr. W. R. Rawlings, the hon. treasurer, referred to the falling-off in registration fees, which, he considered, might have been expected as the number of eligible contractors diminished. He pointed out that the renewal fees and interest on investments amounted to sufficient to meet the expenditure; therefore, the registration fees from new entrants helped to swell the balance in reserve. It was a tribute to the way in which the inspectors carried out their work that there had been only a small reduction in the receipts.

The retiring members of the Registration Board were re-nominated by their respective associations, and Messrs. Dykes, Cash and Barham were re-elected to the Executive Committee. The chairman expressed Mr. Dykes's regret at his inability to attend the meeting, and paid a tribute to his services to the Register. Mr. Hunter was unanimously re-elected chairman, and Mr. Dykes vice-chairman of the Executive Committee.

Referring to proposed amendments to the bylaws and rules, the chairman said that these were still under consideration, and he hoped that they would shortly be submitted to the Board. Special attention was being given to the question of wages and conditions. The précis appended to the rules and conditions deprecated the employment of inadequately paid labour and the use of boys in unreasonable proportion to that of fully qualified wiremen. But there was nothing specific in the rules themselves bearing upon this matter. Mr. Hunter put forward informally for the Board's consideration a suggestion that something similar to the fair-wages clause embodied in Government contracts should be included in the rules. He pointed out that it would not be policy for the Board to stipulate definitely observance of trade-union wages and conditions.

Mr. H. J. Cash emphasised the need for such a clause, stating that a great deal of discontent existed among many registered contractors regarding the unfair competition and bad workmanship which existed at present. A definite rule on the point would strengthen the hands of the Executive Committee.

Mr. Rawlings moved that the usual donation of ten guineas should be made to the I.E.E. Benevolent Fund, and this was unanimously approved.

Responding to a vote of thanks, Mr. Hunter expressed appreciation of the work of the staff and inspectors. He also mentioned that Mr. E. Calvert was retiring from the Board as a representative of the I.M.E.A., but, happily, the Register was retaining his services in a consultative capacity at "a very inadequate remuneration."

Mr. Calvert expressed his pleasure at being enabled to continue his association with the work of the Register.

Parliamentary News (BY OUR SPECIAL REPORTER)

THE question of the frequency to be employed at the London Passenger Transport Board's power stations was raised when consideration of the Board's Bill was resumed by a Select Committee of the House of Commons on March 31st.

The chairman (Sir H. Cautley) said that some members of the Committee were not satisfied that the Board was adopting the wisest course in employing 25 cycles instead of 50 cycles. He was not well enough equipped himself to discuss the matter, but he understood from Mr. Pick that it had not yet been decided which frequency should be adopted. He also understood that the Ministry of Transport had something to say on the matter and it might be desirable to have the matter further investigated.

Mr. Tyldesley Jones, K.C., said no question had been raised by the Ministry. It would be a battle between one member of the committee (Sir Arnold Gridley) and the Board's engineers. Mr. Pick said it was not an engineering matter but one of policy. Further consideration of the point was deferred.

Mr. T. E. Thomas, general manager of road transport, gave evidence of the programme of trolley vehicle extension. He said that 59 miles of route were now being operated by trolley vehicles and the conversion of 107½ miles of route was now in progress. If the Board was given the power to convert a further 52½ miles, it would have that power in respect of more than half its tramway system. It expected to have 750 trolley vehicles on the road by the end of this year. Mr. Edgar Macassey, counsel for the Hackney Borough Council, opposed this part of the Bill on the ground that a proposed turning place at Stamford Hill would be dangerous.

The Committee approved the Board's proposals, but consideration of other parts of the Bill was adjourned.

Northmet Capital Increase

The North Metropolitan Electric Power Supply Co.'s Bill was considered on April 1st by the House of Lords Committee on Unopposed Bills, Lord Onslow presiding. The company seeks to increase its capital from £5,000,000 to £8,000,000, and asks for authority to borrow a further £1,500,000 in addition to the present authorised loan capital, of which £1,434,040 has already been exercised. Provision is made to enable the company to incur temporary loans not exceeding £1,500,000. It is proposed that any part of the unissued capital may be raised by the issue of first preference shares or stock ranking *pari passu* with the existing 6 per cent. cumulative preference stock. The Bill also empowers the London Passenger Transport Board to sell or lease to the company the Neasden generating station. After formal evidence the Bill was ordered to be reported for third reading.

The North Wales Electric Power Bill

This Bill was considered on April 2nd by the Select Committee of the House of Commons on Unopposed Bills, Capt. R. C. Bourne (Oxford, U.) presiding.

Mr. Dodds, parliamentary agent, said that the North Wales Power Company was set up in 1904 to provide bulk supplies of electricity, but its area had since been enlarged and it was now also a distributor of electricity. The rate of dividend was fixed by a sliding scale related to a standard price of 1½d. per kWh, but the company was, in fact, supplying at an average price of 0.55d.

One of the principal objects of the Bill was to remove the limitation of £1,000,000 on share capital and to increase it to £3,000,000. The latest accounts of the company showed a capital expenditure of £4,000,000, of which £3,000,000 was loan capital. Obviously that disproportion ought to be corrected. The additional capital would be employed in redeeming £300,000 of 7 per cent. debentures, repayment of an advance of £500,000, and in the acquisition for £500,000 of the closely allied Electrical Distribution Co. of North Wales. The remainder would be swallowed up in normal development.

One of the clauses in the Bill dealt with the sliding scale which was based on the average price in the company's original area. It was proposed that in future it should be based on the average price in the whole of the present area and on the suggestion of the county councils, the promoters had agreed not to take into account energy sold in bulk at a very low rate to the Central Electricity Board nor current sold for consumption outside the area.

The Committee found the preamble proved and ordered the Bill to be reported for third reading.

Electrical Inspectors

In reply to a question on April 2nd relating to the number and duties of factory inspectors concerned with electrical apparatus and plant, Mr. Geoffrey Lloyd said that there were nine electrical inspectors of factories under a senior electrical inspector. Their duties were to inspect the more important installations, to assist the district staff in the enforcement of the Electricity Regulations elsewhere, and generally to advise the Department on electrical questions. One was specially assigned to Scotland, two to the Northern Counties and North Wales, two to the Midland Counties, one to the Western Counties and South Wales, and two to London and adjacent counties, while the ninth did special work.

The London Supply Merger

On April 6th Mr. Lathan asked the Minister of Transport whether, in view of the acquisition of over 90 per cent. of the capital of six of the London electricity supply companies which were authorised undertakers by the London Associated Electricity Undertakings, Ltd., which had concluded an agreement with these companies to manage them until 1971, he could state whether the compensation provisions of the Electricity (Supply) Acts, 1882 to 1935, would be applied to the officers and servants of the said companies; and, if not, whether he proposed, in order to protect the statutory rights of the officers and servants concerned, to attach conditions to any consent by the Electricity Commissioners or to introduce legislation for the purpose.

Captain Hudson said that the Electricity (Supply) Acts provided machinery for deciding whether particular cases were covered by the compensation provisions, and the Electricity Commissioners had no authority to deal with this matter in any consent which might be required from them. He was informed that the company had not dismissed any staff and did not at present anticipate that any dismissals would be necessary.

The Electricity Supply (Meters) Bill

Amendments to this Bill which Lord Eltisley is to move in committee include a clause providing that all authorised undertakers (unless otherwise allowed by the Electricity Commissioners) shall install apparatus for the examination, testing and regulating of meters. Another clause enables two or more authorised undertakers to combine for the joint provision of such apparatus. An amendment to Clause 2 provides that an existing meter shall be "deemed a meter proper for the ascertainment of the amount of energy supplied or the electrical quantity contained in the supply and in cases of dispute the register of such meter shall be admissible evidence in any Court of the value of the supply but shall not be conclusive evidence of the matters aforesaid." It is also provided that an existing meter shall fulfil these requirements "until it is disconnected and removed or until the expiration of ten years from the appointed day, whichever is the earlier." A new clause is inserted, relating to the application of the Bill to London.

Bills Advanced

The Yorkshire Electric Power Bill was read a third time in the House of Lords on March 31st and received its first reading in the House of Commons the same day.

The Huddersfield Corporation (Trolley Vehicles) Bill was given a second reading in the House of Commons on March 30th.

Conclusion of the Bradford Inquiry

THE last stage of the inquiry by the Electricity Commissioners into the failure of supply at Bradford on February 24th took place on April 2nd. The earlier proceedings were reported in our issues of March 27th (p. 462) and April 3rd (p. 490).

Mr. T. Roles (city electrical engineer) was recalled, and in reply to Mr. A. D. Mallinson (consulting engineer for certain Bradford manufacturers) stated that the makers of the switchgear involved were replacing the weak insulators when the breakdown occurred. Two switches were being released at a time, and within another three or four weeks the work would have been done. He had had switchgear of the same type in use from 1920, and had not heard of any trouble of this nature in any other part of the country. He expected the gear to be replaced before the end of May. Referring to the means of draining floors and of automatic fire protection provided for the two latest power stations in London, Mr. Roles said the space available at Valley Road was not enough for similar systems there. In Bradford the question of expense had always been second to that of reliability, and he was convinced that the switchgear installed was the safest.

Mr. J. Hacking (deputy engineer, C.E.B.) said that the two grid switches had similar insulation to that on the Valley Road switches; one had been replaced. He added that it was seemingly agreed that the initial fault was on switch No. 69 of the Corporation, and that there was no other fault except that due to the subsequent burning out of the earthing transformer at the grid sub-station.

The second part of the inquiry related to the steps taken to restore the supply. Mr. W. Dundas (deputy city electrical engineer) said that the failure had involved the station in a loss of seventy-five per cent. of its output for the season of the year. The energies of the staff were directed to a gradual, and reliable, restoration of supply.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

E.D.A. Public Speaking Competition Results

The National finals of the E.D.A. Public Speaking Competition were held at the Charing Cross Hotel, London, on March 31st, when the first prizewinners from five areas (ladies) and eight areas (men) gave short talks to an interested audience. The results in the ladies' section were as follows:—Miss M. Thomason (North Metropolitan Electric Supply Co.), first; Miss M. Arguile (Halifax), second; and Miss M. Gould (Walsall), third. Each chose for her subject "How Electricity Helps the Farmer." The winners in the men's section were Mr. E. Didcott (Nottingham), first, who spoke on "How Electricity Helps the Farmer"; Mr. L. F. Ramseyer (North Metropolitan Electric Supply Co.), second, whose subject was "The Influence of Electricity on Health"; and Mr. N. H. Denholm (North Eastern E.S. Co.), third, who also spoke on "How Electricity Helps the Farmer." The judges were Lady Brooke, Miss J. Dunsford, Captain J. C. Chaytor and Mr. G. S. Francis. Sir John Brooke, in complimenting the competitors on their courage in facing a critical audience, paid a tribute to the high standard of the speeches.

The London Casino

Considerable alterations in the electrical equipment have been carried out in connection with the conversion of the Prince Edward Theatre, Old Compton Street, W.1, into the London Casino, which under one roof now provides facilities for dinner or supper, dancing, news films and full stage shows. A new rolling stage with a revolving centre section is operated by Mawdsley motors, an automatic interlocked system coming into action when the safety curtain is raised or lowered. Built into the edge of the circle is a battery of twelve 1,000-W Strand Electric four-colour changers which are controlled from the stage, while above the circle is a glass-fronted projection room, which includes among its equipment six 80-A "Stelmar" spot arcs. Spot boxes have also been placed each side of this projection room. The appearance of the auditorium has been made more attractive by the use of a number of architectural tube wall-brackets (Harcourts), together with an effective scheme of cornice lighting and flush wall and ceiling fittings. The contactor board has been removed from the basement to the wings, where an eight-scene preset light control board has been installed. A J. & A. Hall refrigerator, a "Peerless" mixer and a "Mora" silver burnishing machine are among the electrical apparatus employed in the extensive kitchens in the basement, for which a special Carrier ventilation plant has been provided. There is a Standard inter-house telephone system and plug points are available at each table for G.P.O. telephones. Ediswan lamps are used throughout the building. The Berkeley Electrical Engineering Co., Ltd., was responsible for the electrical work, an exterior neon installation being carried out by Claude-General Neon Lights, Ltd.

Many attractive lighting effects are to be seen at the London Casino, which was opened in Old Compton Street, W.1, last week

A New Lamp Agreement

The Lamp Department of Messrs. Crompton Parkinson, Ltd., has issued a new agreement to lamp retailers, the scope of which is widened, providing for the inclusion of Kye shilling lamps for grading turnover calculation. The company undertakes to provide sales aids, such as free window dressing, and the service of its illumination engineers for the preparation of data for installations on customers' premises. Its own canvassers in each area will hand over to the local dealers orders which they obtain in their districts.

A Medical Catalogue

The Medical Section Annual, 1936, which has been issued by British Industries House, Marble Arch, W.1, is a comprehensive catalogue of medical supplies of all descriptions made by a number of trading concerns. In addition to brief particulars of the various apparatus, there is a general index of appliances with the names of the makers. The introductory matter includes information and a description of the equipment displayed in the medical section at British Industries House.

Recent Contracts

The open-air swimming pool at Westcliff-on-Sea is to be brought up to date by the installation of a filtration plant and an electric boiler for heating. The contract for the complete equipment, including circulating, filtration, aeration, sterilisation and electrical heating plant, has been placed with Messrs. Bell Bros. (Manchester 1927), Ltd. The electric boiler and equipment will be supplied by Messrs. Bastian & Allen, Ltd., and electricity will be provided by the Southend Corporation Electricity Department.

The Keighley Electrical Engineering Co., Ltd., has received an order from the Leeds Corporation for twenty-five lifts for the first section, comprising 239 dwellings, of the artisans' flats being erected at Quarry Hill.

Cable Manufacture in South Africa

The monthly report of the Nederlandsche Bank voor Zuid-Afrika reports that a company is to be formed with a capital of £1,000,000 for the manufacture of electric cables at Vereeniging. The works is to produce most of the requirements of

the Union, and it is assumed that at a further stage it will be able to satisfy the whole of the inland demand to an amount of £1,250,000 per annum.

Electrical Production in Poland

It is reported from Warsaw that the production of electrical goods in Poland has made great progress in recent years. The output of machines increased from 759 metric tons in 1934 to 855 tons last year; transformers from 290 tons to 426 tons; accumulators from 1,336 tons to 1,402 tons; meters from 106 tons to 144 tons; lamps from 6,300,000 tons to 9,500,000 tons; and plain and insulated wires and cables from 6,077 tons to 8,610 tons.

A Reflector Display

A special display of industrial reflectors was recently arranged at the Stoke-on-Trent electricity showrooms by Benjamin Electric, Ltd., in collaboration with Mr. C. H. Yeaman, city

— Industry Goes Modern —
IF THIS WHOLE FACTORY IS MODERN
THE INTERIOR CAN BE MODERN
BENJAMIN PLANNED LIGHTING
BENJAMIN PLANNED LIGHTING

A display of Benjamin reflectors at Stoke-on-Trent

electrical engineer. As our picture shows, the various reflectors in the foreground and at the top of the window are standard Benjamin industrial and commercial lighting products, the intention of the display being to create and foster an increased interest in correct artificial lighting in the area.

Works Visit

The accompanying illustration shows a group of distinguished visitors at the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd. The stator behind the group is for a 12,500-kVA water-wheel driven set which is one of three for the Mettur Hydro-electric Scheme, India. Dr. Earle Page, Deputy Prime Minister of the Commonwealth of Australia and Minister of Commerce is in the centre between Mr. Bailey and Mr. Peck (director). Mrs. Page is on Mr. Bailey's right and next to her is Mr. J. F. Murphy, secretary of the Department of Commerce. Mrs. Murphy is on the left of Mr. Peck next to Mr. Fleming (director). The group also includes Mr. Ellis and Mr. Marcusson, officials of the Ministry of Commerce, Canberra. Dr. Page and his party stayed at the Metropolitan-Vickers guest house during their visit to the North and Dr. Page was the guest of honour at the Metropolitan-Vickers Overseas Association's dinner at the Midland Hotel, Manchester, on March 31st.

Australian visitors at the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd.

"Vickcen" Separators

Messrs. Vickers inform us that the Alfa-Laval Co., Ltd., of Brentford, has acquired from Messrs. Cooke, Troughton & Simms, Ltd., the business of British Separators, Ltd. The machines sold by the latter company are "Vickcen" separators, and have been installed in the *Queen Mary*. The purchasers are making adequate arrangements for the "servicing" of these separators and the supply of spare parts. All inquiries for "Vickcen" separators, filters and parts should be addressed to British Separators, Ltd., at their new address, Great West Road, Brentford, Middlesex.

Trade Announcements

Mr. J. A. Woods, A.M.I.E.E., of Atlas Chambers, 88, Westgate Road, Newcastle-on-Tyne, has been appointed by M. & C. Switchgear, Ltd., as its agent for the Northumberland, Cumberland, Durham and Westmorland district.

The Collier Electric Co., Ltd., has removed to Colmac Works, Edwin Road, Twickenham, Middlesex. (Telephone: Popesgrove 3808.)

Mr. J. L. Gaved announces that he has ceased to trade as the Better Lines Co., and is continuing in his own name with an office at 7, St. Stephen Street, Bristol. All matters previously dealt with at the Mile Oak, Tamworth, office will be given attention at the new address.

New E.C.A. Members

At the last meeting of the Council of the Electrical Contractors' Association the following were admitted to the membership:—

Distributors (Tate & Co.), Ltd., Regent Street, W.1.
Pain & Lungley, South Norwood, S.E.25.
D. L. Chittenden, Chesham.
Wright & Pull, W. Southbourne, Hants.
Radio Supply Depôt, Taunton.
Southcombe & Willcocks, Plymouth.
Nicholas & Jones, Llanelly.
W. L. Horrobin, Birmingham, 3.
Wood Bros., Heanor, Notts.
F. W. Radford, Beeston, Notts.
E. J. McCabe, Southport.
R. J. Jones, Rhyl.
G. M. Brewster, Levenshulme, Manchester.
T. Tomlinson, Bury.
Venus Radio & Electrical Co., Ltd., Huddersfield.

Easter Holidays

The London office of the Jackson Electric Stove Co., Ltd., closed down yesterday (Thursday) and will reopen on Wednesday morning next.

For Sale

Brighton Electricity Department has for sale ten tons of electrolytic copper bar.

Bexhill Electricity Department invites offers for the purchase of a motor convertor with l.p. panel, three sets of rectifiers with transformers, &c., and 1,700 meters.

(See our classified advertisements.)

Change of Name

Messrs. Ismay (Rawson), Ltd., have changed their name to Ismay Distributors, Ltd.

An Argentine Lamp Company

The Osram Compania de Lamparas Electricos is the name of a new concern which has lately been organised in Buenos Aires with a capital of $500,000 (paper) to undertake the manufacture and sale of electric lamps in Argentina.

A Miner's Lamp Offer

It is reported in the daily Press that impressed with the importance of developing a satisfactory lamp for use in mines, which will not only give an automatic and unfailing signal of the presence of fire damp, but will also provide the maximum illumination for working purposes at the coal face, the Central Committee of the Mining Association at its meeting held on April 2nd decided to offer a prize of £500 for such a lamp as will pass the necessary official tests.

Electric Cooking in France

The French Société pour le Developpement des Applications de l'Electricité has recently issued the results of its inquiries into the progress of electric cooking in France and North Africa during the past year. They show that at the end of September last 117,882 electric cookers and other domestic cooking appliances were in use as compared with 81,451 at the corresponding date in 1934, an increase of 36,431 units, or over 44 per cent., in twelve months. The return also shows that no

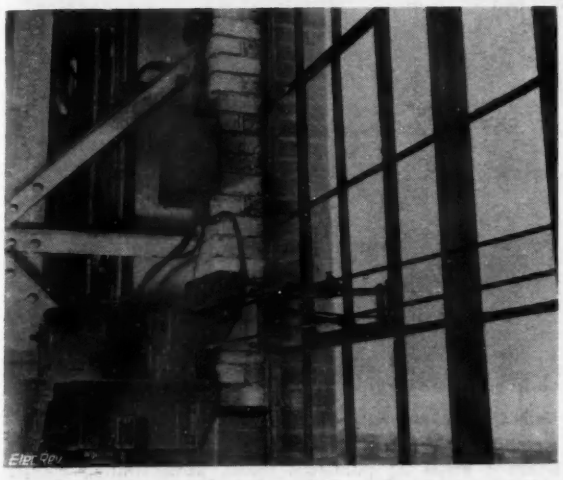
fewer than 243 buildings comprising 5,895 flats are entirely equipped with electric cooking apparatus, representing a load of 18,054 kW. As regards commercial installations, the return shows that there are now in France 422 restaurants, ninety-nine refectories and school canteens, fifty-seven hospitals, clinics and sanatoria and seventy-nine cake, bread and cooked meat producing establishments equipped with electric cooking installations, while 1,845 other premises have at least one electric cooker.

New Municipal Showrooms

The Bexhill-on-Sea Corporation has been recommended by its Electricity Committee to establish a showroom for the demonstration, sale, hire and hire-purchase of domestic electrical appliances. It is also proposed that all necessary wiring shall be placed with approved electrical contractors; that lamps shall not be sold, but sample lamps exhibited; and that sales shall be made direct by contractors, the Corporation taking 5 per cent. of the amount involved. Pending the establishment of the showroom, cookers, &c., are to be let on hire from the Ashdown Road works, and a sum not exceeding £500 is to be expended out of revenue for the purchase of apparatus, subject to the approval of the Electricity Commissioners. As to other appliances and fittings, the contractors are to stock the showrooms and submit a scheme for dealing with sales.

An Electric Window Device

The accompanying illustration shows an unusual electrical device which is used extensively in the Dagenham works of the Ford Motor Co., for opening and closing the windows. The



An electrically operated device for opening and closing windows at the Ford Motor Co.'s works

power is provided by a 1-h.p. Parkinson motor, intermittently rated, running at 1,460 r.p.m. and driving through reduction gearing. Push button controls marked "open" and "close" are fitted. There are seventy of these units in operation at the Ford works.

Uruguayan Telephone Duty Exemption

A Uruguayan legislative decree dated December 31st last provides that private telephone companies operating services in the interior of the country shall be exempt from import duty on materials imported for reconstructing and improving their lines and exchanges, both urban and rural, provided the material is not of a kind manufactured in Uruguay.

Municipal Trading at Cheltenham

The local electrical contractors have sent a deputation (comprising Messrs. Haddock, Bastin, Tandy and Honeysett) to the Cheltenham Corporation urging that it should abandon the direct selling of electrical appliances and apparatus. A sub-committee is to be appointed to go into the matter.

Social Events

The third annual Arts and Crafts Exhibition of the employés of the London Electric Wire Co. & Smiths, Ltd., was held on April 4th at the company's Leyton factory. Over forty separate classes were included, such as woodwork, metalwork, drawing, painting, photography, embroidery, rug-making and cookery. The exhibition was opened by Mr. E. Leete, managing director, and about 600 visitors attended. Three prizes were given in each of the forty-eight classes.

The G.E.C. head office travellers' twenty-eighth annual dinner was held at the Connaught Rooms on April 3rd, with Mr. T. W. Heather (sales manager) in the chair. Those present included Messrs. M. J. Railing (vice-chairman and joint managing director), S. D. White and F. Winstanley, as well as a representative gathering of all departments at the head office. Telegrams of good wishes were received from Lord Hirst and from Mr. L. C. Gamage who is now in New Zealand.

The Manchester Business Houses Cross-Country Championship has again been won by employés of the Metropolitan-Vickers Electrical Co., Ltd. Last year they lost to Manchester Collieries, but previous to this had not been beaten from 1923 onwards. Their victory was largely due to Mr. W. E. Eaton, one of the company's welders. On April 4th Mr. Eaton added another to his numerous successes by winning the A.A.A. ten miles championship at the White City, London. His time of 50 min. 30⅘ seconds established a new British record.

Fostering the Welsh Coal Industry

The Association of Mining Electrical Engineers (South Wales Branch) paid its official visit to the Welsh Industries Fair at Cardiff on April 2nd. Members were received by the chairman of the Industrial Development Council of South Wales and Monmouth, Ltd. Councillor G. Williams referred to the scheme to change over from electrically driven to oil-driven transport in Cardiff, which ignored the fact that the city was largely dependent upon the Welsh coal industry. There would be strong feeling against the proposal, especially since electrically driven transport with its power derived from coal had been so successful in the past. Replying on behalf of the visitors, Mr. J. Vaughan Harries (vice-president, S.W. Branch Association of Mining Electrical Engineers) said that while the new station at Swansea had as a prime motive the burning of anthracite coal, Cardiff proposed to run buses by means of imported oil. He expressed admiration for the Development Council's efforts to bring local industries to the forefront, and he assured that body of the mining electrical engineers' co-operation. About thirty million tons of coal was burned annually at power stations in this country. The result of all municipalities changing over to oil-driven transport would have a sad effect on the mining industry. He sincerely hoped that the Cardiff Corporation would be prevailed upon to continue the use of electricity.

A Guide to Edinburgh

In view of the forthcoming I.M.E.A. Convention at Edinburgh, the publication by the Edinburgh Corporation of a booklet entitled "Where to Stay When in Edinburgh" is timely. In addition to tabulated information of hotels and boarding houses, particulars of the Corporation transport services are given.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price. April 7th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur Commercial ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil ... ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£197	£1 inc.
Grade II... ... ... ,,	£136	£1 inc.
Grade III ... ... ,,	£71	—
c Brass (rolled metal 2" to 12" basis) ... per lb.	7⅝d.	—
c ,, Tubes (solid drawn) ... ... ,,	9¼d. to 10d.	—
c ,, Wire, basis ... ... ,,	7⅝d.	—
c Copper Tubes (solid-drawn) ... ... ,,	10½d.	—
g ,, Bars (best selected) ... per ton	£68	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£41	—
d ,, Wire Rods ... ... ,,	£47	—
d ,, ,, H.C. Wire ... per lb.	7⅝d.	—
f Ebonite Rod ... ... ,,	1/6 to 2/– plus	—
f ,, Sheet ... ... ,,	1/3 to 1/6 10%	—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	9d.	½d. inc.
i Iron, Pig (Cleveland No. 3) ... per ton	67/6	—
i ,, Wire galv. No. 1, P.O. Qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£18 5s.	5s. dec.
g Mercury ... ... per bot.	£12 to £12/10/–	—
e Mica (in original cases) small ... per lb.	6d. to 1/–	—
e ,, ,, medium ... ,,	5/– to 10/–	—
e ,, ,, large ... ,,	10/6 to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	11½d.	—
p ,, ,, rolled strip & sheet ,,	11¾d.	—
p ,, ,, wire ... ... ,,	1/0½	—
o Platinum ... ... per oz.	£7	—
d Silicium Bronze Wire ... ... per lb.	8½d.	—
g Spelter ... ... per ton	£15 7s. 6d.	15s. dec.
r Steel, Magnet, in bars ... ... per lb.	7½d.	—
g Tin, Block (English) ... ... per ton	£214 15s.	£2 15s. dec.
m ,, Wire, Nos. 1 to 16 ... ... per lb.	2/8	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

New Catalogues and Lists

Richard Crittall & Co., Ltd., Bush House, London, W.C.2.—Leaflets dealing with the new "Dulrae" electric bed warmer and the "Crittall" portable air conditioner.

Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10.—A price list of flexible cords and cables.

Mitchell Electric Co., Ltd., Wheeleys Lane, Five Ways, Birmingham, 15.—Leaflets describing and illustrating electric fires.

E.M.B. Co., Ltd., Moor Street, West Bromwich.—Catalogue sheet No. E.209 describing contactor controllers.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Particulars of the new 150-W "Osira" electric discharge lamp.

Bankruptcy Proceedings

A. W. Hovell, 22, High Street, Beckenham, Kent, wireless dealer.—The public examination in this matter was continued at the County Court, Scarbrook Road, Croydon, recently. Debtor had filed a statement of affairs which showed gross liabilities of £3,059, of which £2,974 was expected to rank for dividend. There were net assets of £373, with a deficiency of £2,602. Debtor attributed his failure to disagreements with partners, heavy expenditure, and difficulties in connection with the hire-purchase side of the business. The Official Receiver observed that from January, 1932, to the date of the receiving order the drawings totalled £2,986, but the net profits were only £222. The examination was adjourned for closing.

C. R. Miskin (trading as Miskin & Rice), electrical contractor, Bush House, Aldwych, W.C., and late of 31, Windmill Street, W.—The public examination of this debtor was held on April 3rd at the London Bankruptcy Court, the accounts showing total liabilities of £1,170 (ranking £1,139) and assets of £89. The debtor stated that in June, 1934, he began business at 31, Windmill Street under the style of "Miskin & Rice." He obtained various contracts, but always experienced difficulty in finding working capital to execute them. Since September, 1934, he had secured several sub-contracts on which he had to make allowances to the contractor, in consequence of which they proved to be unremunerative. The examination was concluded.

F. T. Wood, trading as Wood & Jackson, Boundary Works, Wragby Road, Lincoln, electrical contractor.—This debtor's public examination was held recently at Sessions House, Lincoln. The statement of affairs submitted showed a deficiency of £40. Debtor said he had been employed in the electrical trade for some years, and commenced business on his own account in April last year. He employed his stepson, but there was no partnership between them. He attributed his failure to loss on contracts, heavy travelling expenses, and insufficient capital. The examination was closed.

H. L. Rowlands, electrician, 28, Chalcot Crescent, Regents Park, N.W.—Receiving order made March 27 on debtor's own petition. Public examination May 26th at Bankruptcy Buildings, Carey Street, W.C.

B. Bell, electrical engineer, Ladbrooke House, London Road, Biggleswade.—Trustee, Sir Thomas Keens, 11, George Street West, Luton, released January 22nd.

R. Robinson, electrical engineer, The Arcade, Waterfoot.—Supplemental dividend of 4d. in the £, payable April 9th at the Official Receiver's office, Byrom Street, Manchester.

L. Hardaker, radio and electrical engineer, 32, Broadgate Walk, Horsforth, Leeds.—Receiving order made April 1st on debtor's own petition

E. H. Newman and **M. Baynes** (Langham Radio), lately of 96, Regent Street, W.1.—Trustee, Mr. W. S. Hood, Bankruptcy Buildings, Carey Street, W.C., Official Receiver, released March 21st.

W. J. Davies, radio and electrical engineer, 230, Great North Road, Woodlands, Doncaster.—Trustee, Mr. F. E. Bendall, 27, York Street, Sheffield, released February 20th.

L. Marson, electrical contractor, 81, Norwood Road, Herne Hill, S.E.—Last day for receiving proofs for dividend April 18th. Trustee, Mr. L. A. West, Bankruptcy Buildings, Carey Street, W.C., Senior Official Receiver.

E. J. Levermore, electrician, The Cycle Shop, Queen's Road, Weybridge, Surrey.—Last day for receiving proofs for dividend April 21st. Trustee, Mr. C. R. Waterer, 29, Russell Square, W.C., Official Receiver.

M. Chesler, wireless and electrical dealer, 186, St. Paul's Road, Balsall Heath, Birmingham.—First and final dividend of 1s. 3d. in the £, payable April 9th at Midland Chambers, Warwick Passage, Corporation Street, Birmingham.

R. J. Eggleston, electrical merchant, Huddersfield Buildings, Talbot Road, Port Talbot, Glam.—First and final dividend of 4s. 8d. in the £, payable April 17th at 35, Windsor Place, Cardiff.

H. L. Ruff, 141, Abbeydale Road, Sheffield, electrical engineer.—The public examination of the above debtor was closed on April 2nd at the County Court Hall, Bank Street, Sheffield. The statement of affairs disclosed liabilities of £58 and assets of £29.

Company Liquidations

Mead Electric Co., Ltd.—Meeting April 30th at Balfour House, Finsbury Pavement, E.C., to receive an account of the winding-up by the liquidator, Mr. W. A. J. Osborne.

City Wireless Co., Ltd.—Meeting May 4th at 1-3, Stanley Street, Liverpool, to receive an account of the winding-up by the liquidator, Mr. P. E. Beaver.

Dissolutions of Partnership

W. H. Phillips & Co., wireless and electrical engineers, 358, Footscray Road, New Eltham.—Messrs. W. H. Phillips and H. W. Kirkby have dissolved partnership. Mr. Phillips will attend to debts.

Plew & Dear, radio manufacturers, 22, George Street, Hanover Square, W.—Messrs. J. T. Dear and F. Plew, Jnr., have dissolved partnership. All debts have been paid.

Kilby & Young, electrical engineers, 9B, Market Hill, Luton.—Messrs. S. Kilby and E. A. Young have dissolved partnership. Mr. Young will attend to debts.

Electricity Supply

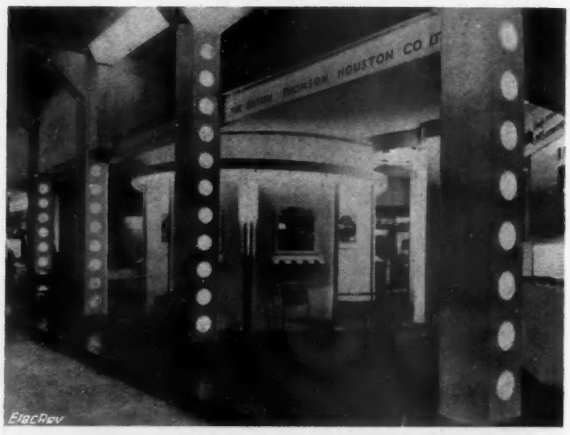
Lighting, Domestic, Power

Ascot.—Charges Reduced.—The Gas & Electricity Co. has reduced its flat rate for electric lighting from 7d. to 6½d. per kWh and the "unit" charge of the all-in tariff from 2d. to 1½d. per kWh. For power the charges are: Up to 100 kWh per quarter, 4½d. per kWh; 100 to 250 kWh at 3½d.; beyond at 2½d.

Australia.—Proposed Queensland Board.—The Queensland Minister for Works (Mr. H. A. Bruce), having investigated the electricity supply administration in New South Wales and Victoria, has recommended the establishment of an advisory board on the lines of that operating in N.S.W. to co-ordinate the supply in Queensland.

New Plant and Extensions.—The Clarence River County Council proposes to borrow £90,000 for additions to power plant and £70,000 for rural extensions. Tenders have been invited for new plant for the Nymboida hydro-electric station and the Lismore oil-driven station.—*Electrical Engineer and Merchandiser.*

Municipal Trading.—A conference at Sydney recently decided to appoint a sub-committee to investigate and report upon means of reconciling the opposing views on the subject of retail trading by municipal electricity supply undertakings.



Extensive use has been made of "Mazda" architectural lamps at the stand of the British Thomson-Houston Co., Ltd., at the Ideal Home Exhibition, Olympia. The central exhibit comprises a series of miniature rooms demonstrating modern methods of domestic illumination

Blackburn.—Special Tariff.—Tenants on the Longshaw municipal estate may now pay 1s. per week, collected with the rent, to cover the use of 126 kWh per annum, all further electricity consumed being charged for at ½d. per kWh. It is intended, in due course, to make the tariff available on other estates.

New Meters.—A loan of £3,000 for the purchase of electricity meters has been sanctioned.

Blackpool.—Frequency Standardisation.—The Electricity Committee has obtained sanction to borrow £39,200 for the standardisation of frequency.

Feeder Extensions.—Three feeders are to be extended from the power station to Central Drive and the Park Road area.

Bolton.—Rate Contribution.—At a recent meeting of the Town Council the question of whether or not the Electricity Department should contribute £10,000 towards the relief of the rates was discussed. It was stated that if the contribution were made the rates would only go up 6d. instead of 9d. The Electricity Committee had, however, deleted the grant from its estimates. Coun. Pilling pointed out that the Department had already contributed £98,000 to the rates, and that its net debt was £904,000. There was a loss on its working last year and the Committee was budgeting for a loss next year. The Council decided that the contribution should be made.

Sodium Discharge Lamps.—Forty new sodium electric-discharge lamps along a mile of Derby Street, Bolton, were switched on for the first time on April 3rd.

Cardiff.—Larger Kiosks.—At a cost of £1,580 the Electricity Committee is to enlarge four electricity kiosks.

Cheltenham.—New Equipment.—A scheme for the relaying of cables, involving the provision of additional switchgear and transformers at a cost of £20,075, has been approved by the Electricity Committee.

Crewe.—Lower Charge.—The Corporation has reduced its lighting flat rate by ¼d. per kWh.

Croydon.—Extended Sodium Lighting Installation.—On December 8th, 1932, Messrs. Philips Lamps, Ltd., completed in Purley Way, Croydon, an installation of sixty "Philora" sodium lamps of the 100 W d.c. type. The Corporation has now placed an order with the company to increase the original scheme to 235 150 W "Philora" a.c. sodium lamps over the

original stretch and an additional three miles. This scheme, which will be completed in about three months' time, will be one of the most comprehensive in the country. The new 150 W lamps will be used in conjunction with the "Liverpool" type unit designed by Mr. P. J. Robinson, city electrical engineer of Liverpool, and manufactured by the Wardle Engineering Co. The installation is being carried out under the supervision of Mr. F. N. Rendell-Baker, chief engineer of the Croydon electricity undertaking.

Durham.—UNIFORM STREET LIGHTING.—Consideration is being given by the Durham County Works Committee to a scheme for a uniform system of lighting throughout the 200 miles of county roads.

Eastbourne.—WATER HEATERS ON HIRE.—The Electricity Committee has agreed to the hiring out of 3-gal. water heaters for 3s. a quarter and the 12-gal. size at 4s. 9d. per quarter to new applicants.

East Ham.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £10,400.

Eccles.—NEW TARIFF.—The Electricity Committee has adopted the following tariff for small power supplies:—First 250 kWh, 2½d. per kWh; next 4,750 at 1½d. and all over 5,000 kWh at 0.8d.

Epsom and Ewell.—LOWER CHARGES.—The Urban District Council has reduced its flat rate from 8d. to 6d. per kWh, with lower minimum charges, and on the alternative "all-in" rates the summer running charge has been reduced to ½d. per kWh.

Finland.—LIGHT AND POWER.—The Rouhiala Rapids below Imatra have been acquired for the purpose of hydro-electric development jointly by the Enso-Gutzeit O/Y, Kymmene A/B, Yhtyneet Paperitehtaat, Tammerfors Linne och Jernmanufaktur, A. Ahlström and the Etelä-Suomen Voima. The power station is designed for a capacity of approximately 100,000 h.p. and will provide 70,000 kW for distribution in Eastern and Southern Finland. Dams are being constructed below the Rouhiala and Ollikkala Rapids to provide a head of water of 14.85 metres. Work is already fairly advanced, and it is hoped that the power station will be in operation in 1937. The water turbines for the station have been ordered from the Finnish firm Tammerfors Linne och Jernmanufaktur, while a contract for four large generators of 37,000 h.p. each has been placed with Siemens-Schuckert. This is said to be the largest electrical contract ever placed by a Finnish concern. According to a D.O.T. report that has just been published (price 1s. 3d.), the Imatra power station has also been extended by the addition of a further water turbine of 32,000 h.p., coupled to a three-phase, 10,000-11,000 V, 29,000 kVA generator. The contract for the former was placed with the Tammerfors Linne och Jernmanufaktur and for the latter with A.S.E.A., which supplied the original generators. The town of Björneborg, in conjunction with several important industrial firms in the neighbourhood, is reported to be investigating a scheme for the exploitation of the Harjavalta Rapids in the Kumo (Kokemäki) River. It is understood that the project incorporates the installation of four turbines of 34,000 h.p. each, coupled to generators producing 24,000 kW. Approximately Fmks.100 millions would be required to finance the scheme. The plan is only in the initial stage.

Glasgow.—INSTALLATION WORK.—The Joint Committee on Electrical Installations in Corporation Properties has approved of the principle of centralising the administrative and technical duties involved in the installation of all electrical work in properties belonging to the Corporation. A special sub-committee is to prepare a scheme to give effect to the proposal.

Great Bardfield.—FRINGE ORDER PROPOSAL.—The London Electric Supply Corporation, Ltd., is unwilling to agree to the proposal of the East Anglian Electric Supply Co., Ltd., to apply for a Fringe Order to supply electricity to the village.

Guildford.—SUPPLY IMPROVEMENTS.—Mains are to be extended and sub-stations provided by the Electricity Committee, at a cost of £7,835, to improve the supply at Boxgrove, Merrow and Clandon.

Hastings.—EXTENSION.—The Electricity Committee is to provide a supply to Beckley at a cost of £967.

Keith.—ELECTRICITY FOR STREET LIGHTING.—A contract for converting street lighting from gas to electricity in Keith has been secured by Messrs. T. Laurie & Co., Falkirk.

Lancaster.—LOWER CHARGES.—The following alterations in the tariffs, to take effect as from the June quarter, are recommended by the Electricity Committee: "Unit" charge under the "electric home" tariff in the borough to be reduced from 0.5d. to 0.4d.; business premises to be reassessed with a view to proposals being framed for reductions in the "service" tariff and "private house and shops combined"; the period 8 a.m. to 9 a.m. be added to the existing period of restriction under all "restricted hour" tariffs; the running charge under the "electric home" prepayment meter tariff to be 0.5d. per kWh net; the two existing power tariffs to be combined and the charge for the first 300 kWh used in any quarter per b.h.p. to be reduced from 2d. and 1½d., to 1½d. per kWh respectively, and the power demand tariff to be altered to include lighting and power in factories.

A SPECIAL ORDER.—Application is being made by the Electricity Committee for a Special Order to supply electricity to Forton and parts of Winmarleigh and Nether Wyresdale.

Richmond (Surrey).—ELECTRIC STREET LIGHTING.—A number of the main thoroughfares of Richmond were switched over to electric lighting from gas last week. These streets include Kew Road, Sheen Road, Petersham Road, Richmond Hill, Sandycombe Road, Church Road, King's Road, Queen's Road, Mount Ararat Road and Red Lion Street, a total of ten miles. The Richmond (Surrey) Electric Light & Power Co., Ltd., installed the new lighting system.

Photographs of the Church Road lighting are reproduced below.

Surrey.—OVERHEAD LINES INQUIRY.—It was announced that a compromise had been reached in regard to one of the schemes when the adjourned Ministry of Transport inquiry into opposition to proposals of the London and Home Counties Joint Electricity Authority to erect overhead lines to complete a fairly large rural electrification project was resumed last week. It was explained that in the case of the proposed line between Westcott and Abinger Hammer the parties had agreed that this should be laid underground in the verge of the main Dorking-Guildford road up to a point known locally as Mark Ash. From that point it would follow the same route as proposed by the promoters to the junction of the existing overhead line, and this portion would be overhead. There was, in addition, an option to be given to the two landowners concerned to require that the line should be put underground, either in whole or in part. The owners, if they exercised that option, would be responsible for paying the whole of the extra cost of so placing the line underground, including any extra cost from stepping down from overhead to underground, such extra cost to be determined, in default of agreement, by arbitration. The Inspector (Mr. T. J. D. Atkinson, K.C.) described the compromise as very reasonable and excellent. The inquiry was again adjourned so that the solicitor for the owner of an estate who was an objector to the second scheme (a line between Broadmoor and Coldharbour) could have time to give the matter further consideration.

London.—SOUTHWARK.—Sanction to a loan of £20,804 for mains extensions is being sought by the Electricity Committee.

The following additional rate for business premises is recommended: A quarterly standing charge of £3 per kW of lamps installed plus ½d. per kWh, subject to a twelve-month agreement.

FULHAM.—The Borough Council has been recommended to convert the remaining gas street lighting to electricity at an estimated cost of £2,137, of which £1,826 represents expenditure on the necessary extensions of mains. The Electricity and Lighting Committee reports that the existing gas lamps are more costly in running charges and maintenance than electric lamps, and that a saving of £80 per annum would be effected.

L.C.C.—It is proposed that for electrical installations con-

The former gas (left) and new "Osira" electric-discharge lighting in Church Road, Richmond

tracts, other than machinery, the retention money, pending satisfactory completion of the period of maintenance, shall be 10 per cent. instead of 20 per cent. as at present.

Lewisham.—The installation of electricity in houses on the Grove Park estate at a cost of £1,206 is recommended to the Borough Council.

Luton.—Refusal to Connect Heating Installations.—The borough electrical engineer recently declined to authorise the connection to the mains of heating installations in certain houses at Dunstable on the ground that the wiring did not comply with the regulations. One of the consumers asked the Electricity Commissioners to appoint an inspector to settle the matter, and he reported that it would have been reasonably practicable to prevent danger at a cost of a few shillings by employing a larger cable for the two heating sub-circuits, and the Corporation was justified in exercising its rights in refusing to give a supply. He directed the consumer to pay the costs.

Maidstone.—Overhead Line Refused.—As the outcome of a local inquiry, the Ministry of Transport has refused the application of the Corporation for permission to erect an overhead line in Charlton Lane, West Farleigh.

Manchester.—Loans.—Application is being made by the Electricity Committee for further powers to borrow £250,000 and £100,000, respectively, for distributor and feeder mains.

Marlborough.—Change-over.—It was originally intended that the change-over from d.c. to a.c. should be carried out as and when required, but at a recent meeting the Council decided to complete the work this year. The cost is estimated at £18,950.

Newcastle-on-Tyne.—Lower Charges.—The North-Eastern Electric Supply Co., Ltd., has announced a revision in electricity charges. For domestic purposes the final charge has been reduced from ¾d. to ½d. per kWh. The occupiers of small shops at present using normal lighting will benefit by a lower rate for increased illumination and for late-hour window lighting, while those shops which already use sufficient electricity to obtain part of their energy at the lower scales are to obtain an immediate reduction in their payments on the difference between the old and new minimum consumptions. For water heating the charge will be ½d. per kWh all the year round instead of only during the summer months.

Norman Cross (Hunts).—Negotiations for Supplies.—In response to a request for a supply of electricity for Waternewton, the Bells, Cambs & Hunts Electricity Co., Ltd., has replied that it does not think the demand for electricity would warrant the provision of a sub-station, but that if a canvass justified the expense it would provide a supply. The Rural District Council is continuing negotiations.

Plymouth.—Mains Extensions.—The Electricity Committee is to extend mains at a cost of £3,000.

Prescot.—Transfer of Undertaking.—The electricity supply undertaking of British Insulated Cables, Ltd., was transferred to the Liverpool Corporation on April 1st. New tariffs are now available to consumers in the urban districts of Prescot and Huyton-with-Roby and the parishes of Knowsley, Rainhill, and Whiston.

South Shields.—Meters.—Application is to be made by the Town Council for sanction to take £10,000 out of the reserve fund of the municipal electricity undertaking for the provision of meters.

Stalybridge.—The "S.H.M.D." Wiring Scheme.—In our last issue we made brief reference to a new assisted wiring scheme introduced by the Stalybridge, Hyde, Mossley & Dukinfield Tramways & Electricity Board. Mr. J. Harwood Lumsden, the Board's chief engineer, has now sent us further particulars of the scheme, together with a pamphlet that is being circulated in the area. The minimum weekly fixed charge, which is collected through a fixed-charge collector meter, covers the fixed quarterly charge under the domestic all-in tariff and a payment for the installation. All energy consumed is charged at ½d. per kWh. The minimum weekly fixed charge is 11¾d. for three lamps and one light-duty plug. Alternatives are offered up to six lamps and one light-duty plug up to a maximum weekly fixed charge of 1s. 2d. per week. Two heavy-duty plugs, two-way switching for lighting points, and an iron can also be supplied, if required, a further addition to the weekly fixed charge being made. A sum of 5s. is payable by consumers when making application for installation. The pamphlet sets out the various charges and gives concise details of the plan. It also contains a list of registered contractors and a statement of the amount of work one kWh of electricity will do. Mr. Lumsden tells us that the scheme is expected to increase the number of consumers enormously; since March 26th, when the scheme was approved, many applications have already been received. A further tariff reduction has been offered to cotton mill consumers, and an extended period of night working has been granted, during which a further 10 per cent. discount is allowed on the charges for electrical energy used for power purposes.

Tain.—Company to Operate Undertaking.—The Council has agreed to transfer its electricity undertaking to the Scottish Power Co., Ltd. Certain consumers will have to pay more and others less, but if the transfer were not affected the existing charges would have to be increased.

Thanet.—Terms for Purchase of Undertaking.—It is understood that the Margate Corporation and the Broadstairs Urban District Council have arranged terms with the Isle of Thanet Electric Supply Co. under which they will have an option to purchase the company's undertaking at the end of ten years. A joint committee is to submit the proposals to the Electricity Commissioners for preliminary approval.

Thingoe.—Electric Power for Water Scheme.—The Rural District Council has accepted the estimate of the East Anglian Electric Supply Co. for electricity for the Ixworth water scheme. Electricity was estimated to work out considerably cheaper than an oil engine.

United States.—More Electrified Farms.—According to the Edison Electric Institute *Bulletin*, there was an increase of 44,840 farms supplied with electricity during 1935, bringing the total to 788,795, or 12¼ per cent. of all classes of farms in the United States. This compares with an increase of 30,400 in the previous year and with the high record of 113,000 made in 1928. The largest increases occurred in Michigan, with an addition of 8,724 farm customers, and in Ohio with 4,865.

York.—Lower Tariffs.—Reductions in the "unit" charge of the rateable value tariff (outer rural areas) from 1d. to ¾d.; in the minimum standing charge from 15s. to 12s. per quarter; and in the maximum demand tariff from 8d. and 2d. to 7d. and 1½d. respectively per kWh have been recommended by the Electricity Committee.

Traction

London.—Hammersmith to Barking Electric Trains.—The London Passenger Transport Board is now running one through train in each direction between Hammersmith and Barking every morning and evening. A full rush-hour service will begin on May 4th, when new District line rolling stock will be used.

Newcastle-on-Tyne.—Proposed Transport Boards.—The formation of two passenger transport boards in the north-east was suggested by the Mayor of Gateshead (Ald. J. White) in evidence before the Royal Commission on the Unification of Tyneside Local Authorities. He said that one could serve the area from Hartlepool to Berwick and a second the district between Hartlepool and Whitby, and he contended that if the boards controlled the railway as well as the road transport services the anomalies in fares, wages and services could be removed. Earlier in the Commission's inquiries a suggestion was made by Newcastle City Council representatives that a passenger board was necessary for Tyneside authorities.

More Trolley-buses Advocated.—A suggestion that the City Council should scrap all its tram services and introduce trolley-buses throughout its system was made by Sir John Maxwell, chairman of the Northern Area Traffic Commissioners, speaking at the annual dinner of the Associated Road Operators (Northern Regional Area) at Newcastle. Sir John was referring to the trolley-bus service started by the Council on the Wallsend-Denton Burn route, and said that the complete abolition of the trams would ease the city's congestion problem. Later, in an interview, Ald. R. Mayne (chairman of the Newcastle Transport and Electricity Committee) said that the tram services might be completely abolished within eight years. The Committee wanted to utilise the existing capital value of the undertaking as far as possible, and if the Corporation would refrain for a few years from taking the profits from the transport undertaking for other purposes the replacement of trams by trolley-buses could be accomplished easily within the period mentioned.

St. Helens.—Trolley-buses Supersede Trams.—The last remaining tramway route owned by the St. Helens Corporation (St. Helens to Prescot) has been converted to trolley-bus working.

Communications

Afghanistan.—New Radio Stations.—A *Reuter* message from Kabul states that five radio stations are to be built this year.

Great Britain.—Police Radio.—It is reported that at Grove Park, Denmark Hill, three 100ft. radio masts are being erected by the Post Office for the new Scotland Yard radio station, which will enable communication to be maintained with the police over a distance of 40 to 50 miles from London and will, in addition, play a part in the Home Office scheme for regional police stations.

India.—Telephony.—A radio-telephone service between Cairo and Baghdad has been inaugurated.

Irish Free State.—Broadcasting.—The estimate for the broadcast services for the year 1936-7 was introduced in the Dail last week. The amount required is stated to be £57,700, as compared with £40,838 for 1935-6. The revenue from wireless licences last year amounted to about £42,500, an increase of £8,500. The direct expenditure on the broadcasting service was about £50,000, and the number of wireless licences issued was 85,000, an increase of 18,800. Provision has been made for an increase in the power of the Athlone station from 60 kW to 100 kW.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Bacup.—April 22nd. Electricity Department. E.h.p. and l.p. p.i. cables during the twelve months ending April 30th, 1937. (See this issue.)

Barnes.—April 14th. Electricity Department. Mercury-vapour rectifier plant. (March 20th.)

Beckenham.—April 27th. Borough Council. House service cut-outs from May 1st, 1936, to March 31st, 1937. (See this issue.)

Boxhill.—May 5th. Electricity Department. E.h.p. and l.p. switchgear. (See this issue.)

Blackpool.—April 21st. Electricity Department. Meters for one year. (March 27th.)
April 25th. Corporation. One 1,000-kW steel tank rectifier and equipment. (April 3rd.)

Bristol.—April 15th. Electricity Department. E.h.p. and l.p. switchgear. (March 27th.)

Bromley.—April 15th. West Kent Main Sewerage Board. Three electrically driven vertical spindle propeller type pumps with accessories. A. E. Scott Murray, engineer, Park House (deposit £3 3s.)

Bury.—April 16th. Electricity Department. One year's supply of e.h.p. sub-station switchgear. (April 3rd.)

Cardiff.—April 14th. R.D.C. Electricity Department. E.h.p. and l.p. lines and e.h.p. switchgear, and one 50-kVA outdoor transformer. (March 27th.)

Carlisle.—April 24th. Electricity Department. Cable and lamps. (See this issue.)

Darlington.—April 20th. Corporation. Mercury-arc rectifiers. (April 3rd.)

East Africa.—LOURENCO MARQUES.—May 21st. Mozambique ports and Railways Administration. One 25-kVA, 3-phase, 50-cycle alternator, exciter, control and distribution switchboard and accessories. (T.Y. 40023.)*

East Lothian.—County Council. Contractors wishing to tender for electrical work at the additions and alterations to the County Infectious Diseases Hospital should communicate with the county architect, County Buildings, Haddington.

Egypt.—CAIRO.—June 9th. Mechanical and Electrical Department, Ministry of Public Works. Two boilers and one 5,000-kW turbo-alternator set complete with auxiliaries, switchgear, transformers, &c., and two house turbo-alternator sets with building work at the Atf power station. Chief inspecting engineer, Egyptian Government, 41, Tothill Street, London, S.W.1 (deposit £5 2s. 6d., not returnable).

Farnborough.—April 24th. U.D.C. Electrically driven air compressor for the sewage works. (See this issue.)

Fife.—May 2nd. District Asylum Works Department. Electrical fittings for one year. Resident clerk of works, Fife District Asylum, Cupar.

Gainsborough.—April 18th. Electricity Department. Switchboard and transformer. (April 3rd.)

Gateshead.—Town Council. Electric lighting, telephones and bells, &c., in connection with alterations and additions to the Stannington Mental Hospital. F. H. Patterson, borough engineer, Town Hall.

Hastings.—April 30th. Electricity Department. Switchboard and two transformers. (April 3rd.)

Heston and Isleworth.—April 20th. Electricity Department. Transformer and switchgear. (April 3rd.)

Leeds.—April 16th. Housing Committee. Maintenance repairs, including electrical, at housing estates (Group Nos. 3 and 4, containing approx. 5,370 dwellings). R. A. H. Livett, housing director, 26, Great George Street (deposit £2 2s. for each group).
April 20th. Electrical installations on housing estates. (April 3rd.)

Leyburn (YORKSHIRE).—Parish Council. Wiring and erection of fifty-one electric street lamps. T. Hill, clerk, St. Matthew's Terrace.

London.—ISLINGTON.—June 10th. Borough Council. Street lamp columns, emergency battery, installation of fire-resisting apparatus in connection with new switchgear and transformers. (April 3rd.)
STEPNEY.—April 27th. Electricity Department. Electrical materials for one year. (April 3rd.)

Lowestoft.—April 15th. Electricity Department. Cables. (April 3rd.)

Maltby (YORKSHIRE).—April 14th. U.D.C. Electric automatic water booster. Morgan R. Jones, engineer and surveyor, Council Offices.

Manchester.—April 16th. A.c. motors, time switches, kettles and meters for one year. (March 27th.)

Mexborough.—April 14th. Electricity Department. E.h.p. and l.p. cables. (March 27th.)

Morecambe and Heysham.—April 17th. Electricity Department. Materials for one year. (April 3rd.)
April 24th. E.h.p. switchgear. (See this issue.)

Newcastle-upon-Tyne.—City Council. Electric lighting at the Northumberland Road school. T. Walling, director of education, Northumberland Road.

Newport Pagnell.—April 14th. R.D.C. Engineering tools, including electrically driven lathe, drill, tapping and screwing machines, &c., at the waterworks pumping station. Taylor & Wallin, 1, Saville Place, Newcastle-upon-Tyne (deposit £1).

New Zealand.—WELLINGTON.—June 5th. Post and Telegraph Department. Eight miles of single solid conductor rubber-insulated taped and braided cable. (T.Y. 10447.)*
May 26th. Galvanised earth rods. (T.Y. 30005.)*

Northern Ireland.—BELFAST.—April 20th. Electricity Department. Current limiting resistances and 33-kV switchgear and protective equipment. (April 3rd.)

Oldham.—April 20th. Housing Committee. Electric lighting in 162 houses and twelve bungalows on the Stoneleigh estate. Borough Engineer and Surveyor's Office, Town Hall (deposit £1 1s.).

Portsmouth.—Electricity Department. Installation of electric sign. (April 3rd.)

Prestatyn.—April 18th. Electricity Department. L.p. cables, joint boxes, cutouts, &c. (April 3rd.)

Seaham Harbour.—U.D.C. 130 electric 10-gal. wash-boilers, with cable and three-heat switch. Clerk, Council Offices.

Salford.—April 14th. Electricity Department. Electrical installation in 200 houses. City electrical engineer, Electricity Department, Frederick Road.

South Africa.—JOHANNESBURG.—April 18th. City Council. Pole mounting cut-outs during twelve months commencing June 1st, 1936. (T.Y. 10443.)*
April 25th. Two electrically driven centrifugal sewage pumps. (T.Y. 30034.)*
May 5th. Rand Water Board. One 3,000-kW steam turbine driven alternator with auxiliaries, &c., and switchgear. (T.Y. 40017.)*
CAPE TOWN.—April 29th. Electricity Department. Two electric passenger lifts. (T.Y. 5816.)*

Sully (GLAM).—King Edward VII Welsh National Memorial Association. Installation of radio receiving set with nineteen loud speakers, 315 pairs of headphones and 600 yd. of wiring at the Sully Hospital. F. J. Alban, Memorial Offices, Westgate Street, Cardiff (deposit £2 2s.).

Swansea.—April 20th. Electricity Department. Cables. (See this issue.)

Uruguay.—MONTEVIDEO.—May 12th. State Electricity Supply and Telephones Administration. Insulated copper conductors for outdoor use. (T.Y. 10446.)*

Warrington.—April 20th. Electricity Department. Transformers. (April 3rd.)

Wigan.—May 11th. Electricity Department. Cables for one year. (See this issue.)

Wigtown.—April 24th. County Council. Installation of electrical conduit at housing estate. County architect, Stranraer (deposit £1).

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 36, Old Queen Street, London, S.W.1.

Contracts Closed

Birmingham.—Education Committee. Accepted. Electric lighting at the Stechford Lane school (£172) and at Shenley Fields Cottage Homes (£83).—E. Cooper.

Blackburn.—Town Council. Accepted. Meters.—British Sangamo Co.; Aron Electricity Meter; Ferranti. V.i.r. cable.—Mersey Cable Works.

Blackpool.—Housing Committee. Accepted. Electrical installations in forty-four houses on the Claremont estate.—T. W. Bridge & Co.

Cardiff.—Electricity Committee. Accepted. Cables for twelve months ending March 31st, 1937.—Ediswan; Pirelli-General; B.I. Cables.

Dundee.—Works Committee of the Harbour Board. Accepted. Two 3-ton electric travelling jib cranes (£7,450).—Babcock & Wilcox.

East Ham.—Electricity Committee. Recommended. Alterations to wireless equipment.—Harmer & Simmons. Switchboard (£399).—Switchgear & Cowans. H.p. cables.—Enfield Cable Works. Three 250-kVA transformers (£519).—English Electric Co.

Eccles.—Electricity Committee. Accepted. 5,000-kVA induction type pressure regulator (£1,380).—English Electric Co.

Glasgow.—Education Committee. Accepted. Electrical work at Shettleston school temporary extension (£264) and at East Keppoch temporary school extension (£366).—Kennedy, Stark & Co.
Electricity Committee. Accepted. Transformers.—Bruce Peebles; Johnson & Phillips.
Markets Committee. Accepted. Electric pig singeing plant at the slaughterhouse (£948).—North British Lifting & Moving Appliance Co., Ltd. Electric lighting in connection with the extensions at the fish market (£123).—A. Edelman & Co.
Transport Committee. Accepted. Armature coils.—Manchester Armature Repair Co. Compressor.—Lacy-Hulbert. Armatures and coils. B.T.H. Copper trolley wire.—Whitecross Co.; F. Smith & Co.

Hull.—Telephones Committee. Recommended. Table telephones (£2,291).—Automatic Electric Co. Cable (£1,083).—Hogan & Wardrop.

Liverpool.—City Council. Replacing existing grit collectors used in connection with the operation of No. 53 pulverised fuel boiler at the Lister Drive power station (£2,900).—Davidson & Co.

London.—L.C.C.—Housing and Public Health Committee. Recommended. Extension of existing contract for wiring and fittings for electric lighting, &c., in blocks 3 and 6 of dwellings at Friary Estate (Levant Street area), Camberwell, so as to include the electrical installations in block 4 of dwellings at that estate (£230).—Marryat & Place, Ltd.

Plymouth. — Electricity Committee. Accepted. 33,000-V cables (£25,860).—B.I. Cables. Time switches.—G.E.C.; Horstmann Gear Co.

South Shields.—Town Council. Accepted. Equipment for trolley-bus service: Overhead fittings.—A. Wiseman; M. Bonser; B.I. Cables. Wire.—B.I. Cables. Cable.—St. Helen's Cable and Rubber Co. 400 overhead line poles.—British Mannesmann Tube Co.

Notes

London Electric Co-operation

A correspondent writes: "The inauguration of a scheme of co-operation between the London supply authorities is a welcome sign that the electricity supply industry is not content to rest upon its laurels. A scheme has been sponsored by Mr. W. C. Parker, the borough electrical engineer of Fulham, which will provide the supply authorities within the London area with information as to when a consumer is intending to change his place of residence and also the electrical service he has enjoyed in his old area of supply. When an undertaking receives this information it will be in a favourable position to interest its prospective consumer in its own tariffs and hire facilities. In response to a questionnaire circulated by Mr. Parker, it is revealed that only one supply authority out of a total of forty declined to co-operate in the proposed scheme. This willingness of supply authorities to encourage the interchange of reciprocal information will be watched with great interest, as it is Mr. Parker's intention if this experiment should prove successful that the scheme should be placed in the hands of the British Electrical Development Association for general adoption throughout the country."

I.E.E. Meetings

Owing to the Easter holidays only two of the provincial centres of the Institution of Electrical Engineers are holding meetings next week. The Sheffield Sub-Centre are at the Royal Victoria Hotel, Sheffield, 7.30 p.m., on Wednesday, April 15th, when Mr. T. W. Sampson will read a paper on "Further Progress in X-Ray Equipment in a Modern Hospital." The Irish Centre, at the Trinity College, Dublin, 6 p.m., on Thursday, April 16th, will hear the paper on "The High-Pressure Mercury-Vapour Lamp in Public Lighting," by Messrs. G. H. Wilson, E. L. Damant and J. M. Waldram.

Colloidal Graphite

The chief properties of graphite, which is electrically conductive and chemically inert to a high degree, is unaffected by acids and alkalis at ordinary temperatures and is incombustible below 600 deg. C., are discussed in a booklet published by Messrs. E. G. Acheson, Ltd. In the colloidal form the particles between 0.1 μ and 1.0 $\mu\mu$ in size, become charged alike electrically and remain in suspension indefinitely, and when dispersed in suitable carriers can flow through the finest interstices without separation from their vehicle. The Acheson method of manufacturing pure graphite is by means of an electric furnace at 3,000 deg. C. A nine-page bibliography and a list of suggested thesis subjects for investigation by students are included in the publication.

Flue-gas Cleaning Plant

Referring to his lecture on this subject (see our last issue, page 488), Mr. F. Forrest, the chief engineer and manager of the Birmingham Corporation Electricity Department, asks us to state that the total cost of the plant at Nechells & Hams Hall will be nearer £175,000 than £200,000 as was originally stated.

Electricity on the Farm

The Rothamsted Experimental Station, Harpenden, Herts, has published a report of 77 pages (No. XXI, price 2s. net) on the uses of electricity in agriculture as discussed at a conference (reported in the Elec. Rev. at the time) which was held at Rothamsted in January last. Papers reproduced in the report contain details and actual working costs for typical farms; a discussion of various types of motors for specific purposes; advice about farm wiring and earth leakage protection; and an account of official experiments carried out at Rothamsted comparing the consumptions and costs of fuel and electricity as sources of power for thrashing and grinding.

Northern Division E.P.E.A. Dinner

Capt. A. Hudson, M.P., Parliamentary Secretary to the Ministry of Transport, was the principal speaker at the annual dinner of the Northern Division of the Electrical Power Engineers' Association, held in Manchester on Saturday, Mr. H. J. Hadrill presiding. Capt. Hudson remarked that, while the expansion of electricity output for the whole world was only 20 per cent. during the last six years, that of Great Britain had been 70 per cent. With regard to the McGowan Committee's terms of reference, he said that, in his opinion, with some kind of standardisation, the extra electricity that would be required would prevent people being thrown out of work. Mr. J. F. Sarvent (president, E.P.E.A.), spoke of the Association's efforts to improve the educational standards of the profession so that fully qualified men would be available to hold the really responsible positions in the industry. In the scheme of co-ordination of generation there had been arrangements by which some people had been unnecessarily thrown out of employment. Now the co-ordination of distribution was being considered, and he hoped that steps would be taken so that men who would ordinarily become redundant would be absorbed. Mr. L. Hoskison proposed the toast of "The Guests," Ald. W. Walker responding.

E.A.W. Activities

The annual conference of the Yorkshire County Organisation is being held in Hull on April 18th, the programme including an address on "Domestic Supply Costs and Tariffs," by Mr. D. Bellamy (deputy commercial manager, Hull Corporation Electricity Department). The discussion is to be opened by Miss Caroline Haslett, director of the Association. A tour of the electricity showrooms and offices, together with an inspection of the illuminated electric fountain in Queen's Gardens, will conclude the conference.

Fatality

On Monday a woman cleaner employed at a Bournemouth hairdresser's establishment was found dead in the basement. According to the daily Press, her employer heard a scream and, going down into the basement, saw her lying on the wet floor with a flannel in her hand. In some reports she is stated to have been holding one end of an electric light lead.

British Thunderstorm Survey

There were thunder and/or lightning on more days in the summer of 1934 than in the same season of any of the previous three years. The 1934 records made July the most thundery month over the British Isles, with 91 days in four years; while May, the previous holder of this distinction, took second place with 87 days. June was a good third with 81 days, but August's total was much lower, being comparable with April, at about 65 days. The summer records over four seasons as a whole show that thunder occurred on only 60 per cent. of the days; this forms an interesting comparison with the winter survey, between 1927 and 1929, when thunder was recorded on 52 per cent. of the days. The chart maps now show the distribution of storms in greater detail, due to the greater number of observations made, and are being extended into Scotland. The storms again tended to group themselves into bands running roughly north-east and south-west. The main belt of low frequency appeared between Dorset and The Wash, while there was also a suggestion of further alignment in another direction. The area of a few storms in Suffolk was unusual. In spite of a large number of thundery days storms in Scotland covered a smaller area than frequently occurs, Ireland being also somewhat similarly placed. The annual census is being continued this season and new observers, particularly in rural districts and thinly populated areas will be appreciated. No special apparatus is needed and post cards for records will be supplied. Further information is obtainable from Mr. S. Morris Bower, Langley Terrace, Oakes, Huddersfield.

Atmospheric Pollution Exhibition

A comprehensive educational exhibition dealing with smoke abatement and atmospheric pollution is to be opened by the Minister of Health at the Science Museum, London, in October next. It is being specially designed to show the harmful effects of polluted atmosphere, and sections are being arranged by the Department of Scientific and Industrial Research, with the co-operation of organisations representative of the electricity and other fuel industries. During the month the annual national conference of the Smoke Abatement Society will be held at the museum. A special day is to be given over to discussion of the municipal aspects of smoke abatement.

Appointments Vacant

Lecturer in electrical engineering at the Burma Oil Company's College of Mining and Engineering, University of Rangoon.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

Eco cartridge fuses.
Mercoid controls (English agents).
Aeka wires and cables.
Purozone air cleansing apparatus.
Elegan hairdryer.
Canyon lighting fittings.
Campbell electric oven.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. S. G. Horsley, M.A., M.Sc., and **Mr. F. N. Tinkler**, B.Sc., headmaster and first assistant, respectively, of the Dockyard School, Chatham, are retiring at the end of this year on reaching the age limit. At a recent meeting, over which the Rev. H. H. Treacher, an ex-apprentice, presided, it was decided to set up a testimonial fund to mark the above occasion. The presentation will be made at a dinner to be held on September 5th next. Contributions to the fund should be sent to Mr. P. F. Harrop, 86, First Avenue, Gillingham, Kent.

As a result of the entrance scholarship examinations recently held at Faraday House Electrical Engineering College, the following awards have been made:—**Mr. R. C. Werren** (Westcliff High School), the "Faraday" scholarship of eighty guineas a year, tenable for two years in College and one year in one of the works affiliated with the College. **Mr. D. T. Broadbent** (Shrewsbury School), the "Maxwell" scholarship of sixty guineas a year, tenable for two years in College and one year in works. **Mr. E. F. Adams** (Felixstowe County School), an Exhibition of fifty guineas a year, tenable for one year in College and one year in works. **Mr. R. A. Martin** (Colfe's Grammar School, Lewisham), an Exhibition of thirty guineas a year, tenable for one year in College and one year in works. Special entrance prizes of twenty guineas to **Messrs. C. S. Loades** (Westcliff High School), and **R. C. Cooper** (Dean Close School).

Mr. R. M. Hills, whose retirement from Messrs. Gittings & Hills, Ltd., was recorded in our last issue

Mr. W. G. Coates, who has been acting as deputy during the illness of Mr. F. H. Rudd, the Rochdale borough electrical engineer, has been appointed deputy manager of the Electricity Department by the Corporation Electricity Committee.

Mr. P. M. Edinborough was described as the managing director of Elexcel, Ltd., in the article on that company's works published in our last issue. Actually he is manager of the works.

The appointment of **Mr. E. Stewart** as inspector of lighting at a salary of £800, rising to £1,050, and **Mr. J. Ward** as his assistant at a salary of £500 was confirmed by Glasgow Corporation at its last meeting.

Mr. P. K. Davis, A.M.I.E.E., mains superintendent with the Electricity Board for Northern Ireland, has been appointed as superintendent of the outside staff with the North Metropolitan Electric Power Supply Co. Mr. Davis served in the war on active service with the Royal Engineers, Signal Section, from 1916 to 1919. He received his training at Faraday House, the Aster Engineering Co., Ltd., and British Insulated Cables, Ltd. In 1924 he was appointed assistant superintendent of the Contract Department of B.I. Cables, and later was assistant engineer to Messrs. G. V. Twiss & Partners. In 1928 he was employed on rural electrification schemes in Hampshire, South Somerset and Bognor Regis, and in 1930 he was appointed assistant engineer to Messrs. Merz & McLellan, being placed in charge of their Lincoln district for the supervision of the Mid-East England grid construction. He joined the Electricity Board for Northern Ireland as construction engineer, and was later promoted to mains superintendent, in which capacity he was responsible for the supervision of the construction and maintenance of the main e.h.p. system and l.p. network. He commenced his duties with the North Metropolitan Co. on April 1st.

Mr. P. K. Davis

Mr. E. K. Bottle, A.M.I.E.E., the author of the article on "Fractional H.p. Single-phase Motors" on page 527 of this issue, received his technical education at the City and Guilds (Engineering) College, afterwards serving with Messrs. M. W. Woods, of Colchester. He joined the staff of the General Electric Co., Ltd., at Witton, in 1929 as assistant induction motor designer, and in 1934 he was transferred to the newly formed fractional h.p. department, where he is responsible for the design of induction motors.

Mr. E. K. Bottle

Mr. F. B. Richardson and **Mr. T. C. Paton** have been elected to the board of M. & C. Switchgear, Ltd. Mr. Richardson has been with the company for twenty-five years and has been associated with both the B.S.I. and B.E.A.M.A. committees in the preparation of switchgear specifications. Mr. Paton, who becomes sales director, joined the company three years ago, first at the London office and then as sales manager working from the company's Kirkintilloch works.

Mr. H. Fildes has been appointed sales manager of the Cooking and Heating Department, Manchester, of the Hotpoint Electric Appliance Co., Ltd.—not sales *engineer* as stated in our last issue.

Mr. E. Didcott, who, as we announce elsewhere in this issue, has this year secured the premier award in the E.D.A. National Public Speaking Competition, is an assistant on the administrative staff of the Nottingham Electricity Department. This is the third year he has entered for this competition, but the first time he has qualified for the final. Last year he was placed fourth in the Central England Area competition, while in the previous year he secured second place. Mr. Didcott is twenty-three years of age.

[*Jerome, Ltd.*

Mr. E. Didcott

Mr. G. H. Ingamells, Northampton, has been appointed consumers' engineer to the Reigate Corporation at a salary of £300 per annum, subsequently rising to £400.

Messrs. G. A. Ryland's Electrical & Engineering Co., Ltd., of Oldbury, Birmingham, inform us that **Mr. H. Mackinnon**, A.M.I.E.E., has resigned from the position of director of the company.

Obituary

Mr. A. E. Chapman.—The death occurred last week, after a long illness, of Mr. A. E. Chapman, managing director of Tubelight Sales, Ltd. Since the war Mr. Chapman had been identified with several neon enterprises, though more recently he had directed his activities towards the development of low-voltage filament tubular vacuum lamps. He was the inventor of the "Barlux" tube lamp which has been extensively used in "architectural" lighting.

Mr. W. S. Heald, the American general manager of the Shanghai Power Co., died in Cairo on April 6th. According to a *Reuter* message, he arrived in Cairo on March 29th and was almost immediately taken ill with meningitis.

Mr. F. J. Bowerman, who has died at the age of seventy years, founded the business of Bowerman Bros., electricians, forty-five years ago at Southsea, Portsmouth.

Will.—Mr. G. Sperryn, a director of British Brass Fittings, Ltd., and founder of Sperryn & Co., left £46,451, with net personalty £43,710.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Britannic Electric Cable & Construction Co., Ltd.—Private company. Registered March 30th. Nominal capital, £110,000. Objects: To carry on the business of contractors, manufacturers of electrical cables, and bitumen and waterproofing materials, electrical engineers, electricians, mechanical and chemical engineers and contractors, manufacturers of and dealers in cable materials, railway, tramway, electrical and other apparatus, india-rubber, gutta-percha, &c. The subscribers are: D. M. C. Curtis, 15, Cheyne Place, Chelsea, S.W.3, and H. E. Callow, Brooks Grove, Halstead, Kent. Solicitors: Herbert Smith & Co., 62, London Wall, E.C.

Barries Radio (London), Ltd.—Private company. Registered April 1st. Capital, £10,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless and television instruments, equipment and components, gramophones, radiograms, &c. The directors are: H. V. Thomas, 77, Gunnersbury Park, Ealing, W.5; L. F. Peake, 43, Napoleon Road, St. Margarets, Twickenham, Mddx.; A. Barraclough, 177, Gunnersbury Park, W.5; and F. E. Thomas, 162, Coston's Lane, Greenford. Registered office: 91, Ruislip Road, Greenford, Mddx.

Maxolite Holdings, Ltd.—Private company. Registered April 1st. Nominal capital, £100,000. Objects: To acquire rights in connection with inventions relating to electrical dry batteries and all existing British and foreign patents and rights relating thereto; or to the "Maxolite" dry battery, the trade mark "Maxolite," and to adopt an agreement with A. H. Redfern and T. MacCallum. The subscribers are: P. H. Montgomery, 46, Mayfield Road, Moseley, Birmingham; and F. W. Salter, 48, Hawthorn Road, New Oscott, Birmingham. Secretary: B. C. Marsh, 258, Hamstead Road, Birmingham. Registered office: Regent House, Kingsway, W.C.2.

Maxolite Batteries, Ltd.—Private company. Registered April 1st. Nominal capital, £100. Objects: To enter into a licence from Maxolite Holdings, Ltd., to this company to manufacture electric dry batteries, and to make, use, exercise and vend the subject to certain inventions known as the "Maxolite" battery, &c. The subscribers and other particulars are as above.

Newton & Wright, Ltd.—Private company. Registered March 31st with a nominal capital of £50,000. Objects: To adopt an agreement with a company of the same name and R. F. W. Fincham, the liquidator thereof, and to carry on the business formerly carried on by the said company, and that of manufacturers, buyers, repairers and testers of and dealers in electro-medical, electro-surgical, X-ray, electrical, television and other apparatus, automobile, mechanical, electrical and X-ray engineers, &c. The directors are: R. S. Wright (chairman and managing director), "Runswick," FitzAlan Road, Finchley, N.3; E. E. Burnside, 24, Highwood Grove, Mill Hill, N.W.7 (directors of the Irish Electro-Medical Co., Ltd.), and two others. Registered office: 72, Wigmore Street, London, W.1.

Raybar, Ltd.—Private company. Registered March 30th. Capital, £500. Objects: To carry on the business of electricians, sign makers, writers and erectors, factors in electrical goods and appliances, signs, metals, radio, television, &c. The permanent directors are: G. W. Kettlewell, Rusham House, Egham; M. McKerlie, 32, Malden Green Avenue, Worcester Park (directors of Baxter & Caunter, Ltd.), and two others. Registered office: Darnoc House, 33/7, Alfred Place, W.C.1.

Returns of Electrical Companies

Brentwood District Electric Co., Ltd.—Debenture charged on deeds and documents relating to premises at Hutton, Brentwood and South Weald, and the company's undertaking and other property, present and future, including uncalled capital, dated March 18th, 1936, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Brentwood District Electric Installations, Ltd.—Debenture charged on deeds and documents relating to premises at Brentwood, and the company's undertaking and other property, present and future, including uncalled capital, dated March 18th, 1936, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Mawdsley's, Ltd.—Debenture charged on deeds and documents relating to premises at Dursley, Glos, and the company's undertaking and other property, present and future, including uncalled capital, dated March 18th, 1936, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Philips Lamps, Ltd.—The nominal capital has been increased by the addition of £100 beyond the registered capital of £100,000. The additional capital is divided into 100 "B" shares of £1 each.

South Beds Electrical Finance, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated February 10th, 1936, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Pioneer Relay Services, Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1935. 800 shares taken up. £800 paid. Mortgages and charges, nil.

South East Kent Electric Power Co., Ltd.—The nominal capital has been increased by the addition of £100,000 in £1 ordinary shares beyond the registered capital of £150,000.

Bennie Lifts, Ltd.—The nominal capital has been increased by the addition of £10,000 beyond the registered capital of £10,000. The additional capital is divided into 5,000 7 per cent. cumulative preference shares of £1 and 40,000 ordinary shares of 2s. 6d.

City Notes

Associated Electrical Industries, Ltd., held its annual meeting on April 2nd, Sir Felix Pole (chairman) presiding. In presenting the report and accounts (ELEC. REV., March 27th, p. 479), the chairman said that the total capital remained the same but the 4 per cent. debentures were redeemed in July last. All the company's works were well employed during the year. Output was maintained at a high level, and the volume of orders received was satisfactory. Orders in hand at December 31st last were on a higher level than at the end of 1934, and for the first three months of the current year orders received were materially greater than in the first quarter of last year. The progress of the B.T.H. Co. and the Edison Swan Co. had already been referred to at their annual meetings. In the case of the Metropolitan-Vickers Electrical Co., the orders received last year were the second largest in the company's history. As regards apparatus of which manufacture was completed last year, special reference should be made to the 105,000-kW turbo-alternator for the Battersea power station of the London Power Co., the largest ever made in this country. The 24,000-kW turbine operating at a pressure of 1,900 lb. per sq. in. for the Thermotechnical Institute, Russia, was installed and operating satisfactorily. Two 75,000-kVA transformers were completed for the Fulham power station. These units weighed 110 tons each and were amongst the largest in the world. Many important orders were received during the year both for home and for overseas. The largest of these was the contract from the Brazilian Government for the electrification of a portion of the Central Railway of Brazil in and around Rio de Janeiro. From the South African Government they had an order for twenty-five electric locomotives for the Natal Railway extensions. These were similar to ninety-five previously supplied. The Victoria Falls and Transvaal Power Co. ordered two additional 33,000-kW turbo-alternators. Important orders secured in the home market included one from the North Metropolitan Electric Power Supply Co. for a 20,000-kW turbo-alternator, to operate at a steam pressure of 1,950 lb. and a steam temperature of 932 deg. F. and a 30,000-kW low-pressure set. They had also received orders from the London Passenger Transport Board for trolley-bus equipments. With regard to electric traction the "Metadyne" regenerative control system which had been developed by the Metropolitan-Vickers Electrical Co. would have an important influence on railway electrification schemes, several of which were about to be undertaken by the main line railways, as well as by the London Transport Board. Business had been better at home and in the export market, especially in South Africa, whilst there was also an increase of activity in Australia, India and New Zealand. In addition to making the largest apparatus, they also made in the companies of their group a variety of electrical devices, including domestic appliances. They had recently developed at Trafford Park a new material known as "Traffolyte" which should be used extensively in building schemes. The lamp business of their companies continued to expand and three out of four lamps installed in the *Queen Mary* were supplied by companies of the Associated group. Price levels generally for heavy electrical apparatus were still too low, and they were now faced with enhanced costs, due to the rise that was taking place in the price of materials, and the wages increases granted during 1935. The advance in engineering knowledge and the growing complexity of systems for the generation and distribution of electricity gave rise to more exacting technical requirements and made heavy demands on their engineering staffs. To meet these satisfactorily, they had a highly trained staff of engineers and designers who were supported by an efficient Research Department at the Trafford Park Works. Employment in the factories of the group continued to be on a substantially higher level than in recent years, and at the end of the year they had 33,000 employés. The General Electric Co. of America last year sold a large block of its holding of their stock, and a substantial majority of the stock was now held in this country.

The English Electric Co., Ltd.—The statement that the outlook both for the electrical industry and the company appeared at present more favourable than for many years past was made by Mr. G. H. Nelson, chairman and managing director, at the annual meeting held on Monday last. Referring to the new debenture issue (which has been oversubscribed) he said that the conversion would not only reduce interest charges by £10,000 a year and provide funds necessitated by the company's business, but it would materially reduce the sinking fund. The progress made in 1934 had been continued, and orders obtained during 1935 showed a substantial increase over those of the previous year. The volume of business was well distributed over the whole range of their manufactures, and had fully justified the expenditure incurred by the board during the years of depression in the improvement of the old and the development of the new lines of apparatus in anticipation of the demand which was expected to follow a recovery in general business conditions. Although export trade was still extremely difficult owing to exchange restrictions, &c., there had been a distinct improvement in the trade with the Dominions and India, and an increasing amount of business was anticipated. Total exports for 1935 showed an increase of 48 per cent. In view of the activity in railway electrification, both at home and abroad, a section of the Bradford factory had recently been laid out on the most modern lines, and an extensive reorganisation had been carried out to facilitate the manufacture of traction equipment. The manufacturing facilities for domestic products had also been improved, while household meters of various kinds had been developed successfully and were now in production. Results of pioneer work in a.c. welding had justified the layout of a special section of the Stafford works. The company had been successful in training and employing unemployed youths from the depressed areas.

and the average number of employés during 1935 showed an increase of 22 per cent. over 1934. The Southern Railway had accepted a contract for its requirements of electrical train equipments for the next ten years, and the electrification of the Polish State Railways was progressing favourably. The first 80,000-h.p. section of the Galloway Water Power Co.'s order for 145,000 h.p. of water turbines, alternators, and switchgear had been in successful operation for twelve months, and the installation of the second portion was proceeding satisfactorily. The Diesel-electric paddle steamer *Talisman*, for use by the L.N.E. Railway on the River Clyde, was commissioned early last summer and had given satisfactory results. Further orders had been placed by the British Broadcasting Corporation for h.v., d.c. generators for the Northern Ireland and North Scottish stations, and the London Passenger Transport Board had ordered ninety-nine trolley-bus equipments. Other important orders covered the main switchgear for the Fulham central sub-station, bus bodies for the Northern Ireland Road Transport Board, a second 30,000-kW steam turbo-alternator for Sheffield, "luxury" tramcars for Blackpool, three 55,000-kVA banks of single-phase transformer units with on-load tap-changing gear on the 80-kV side for the Victoria Falls and Transvaal Power Co., eight 1,240-h.p. locomotives for the New Zealand Government Railways, and a 3,500-h.p. Diesel engine for the Bermuda Electric Light & Power Co.

A. Reyrolle & Co., Ltd.—The annual meeting was held on April 2nd, when Sir A. N. L. Wood (chairman), who presided, said that the company had in hand a programme of extensions to buildings, partly in the works for the more economical arrangement of detail production, and partly in the offices for the drawing office staff. An associated company, the Bushing Co., Ltd., in which they held one half of the issued capital, supplied them with the greater part of their requirements for certain types of insulators. The value of orders booked during 1935 showed a substantial expansion over the previous year, and was the highest ever recorded. The actual output of completed work was not much greater, but the amount of work in hand at the end of the year was much larger. The total number of employés at present was nearly 4,000, a record, and generally speaking they could look forward to the results of the current year being no less satisfactory than those for the year under review. The first report of the Parolle Electrical Plant Co., Ltd., was issued in July last, and they received a dividend of £10,400. The company was formed to acquire a holding in C. A. Parsons & Co., Ltd., which company was sharing in the improved demand for its specialised manufactures. The demand for the manufactures of J. H. Holmes & Co., Ltd., also showed a satisfactory increase, and it had in hand orders from some of the leading newspapers for its printing press control gear. The remaining subsidiary, the Eureka Vacuum Cleaner Co., Ltd., had improved its position. The short-circuit testing station, which was the first to be installed in this country, had been running continuously throughout the year and the work carried out had resulted in many improvements in design and represented a valuable contribution to the progress of switchgear technique. Their technical department had also made important improvements in the stability of protective systems, particularly in respect of the speedy clearance of heavy power-station faults. Considerable time and money had been spent on the problem of electric water heating, and they had also given attention during the year to l.p. distribution and fuse-gear for use in factories and instruments for testing the efficacy of earthing systems. If the experience of the coming months supported the expectation which the present state of the order book encouraged them to form, they would declare an interim ordinary dividend in September next. It must be emphasised, however, that this did not indicate an increase in the total distribution for the year. In two months' time the company would celebrate its jubilee, it being founded in June, 1886, by Alphonse Constant Reyrolle.

Electrical Industries Trust is the name of a new "flexible" trust concerning the purposes of which a booklet was issued last week. A list is given of forty-one electrical investments in which the trust is permitted to deal; eleven of the concerns are electric supply and power companies, the remainder being manufacturing and equipment companies. Dividends and bonuses paid by these concerns over a period of years, and the approximate yields at the last month's market prices, are tabulated, and the reader is told that if at the beginning of 1935 he had invested £1,000 divided equally between ordinary shares of all these concerns, his holding would have been worth £1,471 by December last. These figures may appear to be very tempting, but they should not suppress inquiry as to what the future is likely to bring. Last year's results included several substantial bonuses, and the popularity of the electrical market was not entirely due to good profits. While it is not unreasonable to expect that there will be some attractive dividends and bonuses during the next twelve months, only the least-informed will believe that the capital increases in respect of the same securities will be repeated, however satisfactory the prosperity of many electrical concerns may be at the moment, for 1935 was a period of exceptional advance in market prices. The trust starts with 10,000 units, and the public is invited to take up from 50 units upwards.

The Anglo-Portuguese Telephone Co., Ltd.—Presiding at the annual meeting held on April 3rd Sir Alexander Roger (chairman) said that the company's progress continued along sound lines. At December 31st, 1928, there were 23,016 stations, which at the end of 1935 had risen to 41,240, an increase of 79 per cent. The share and loan capital in 1928 was £808,200, and this rose to £1,443,190 in 1935. The increase in stations during 1935 was equivalent to a growth of 6.75 per cent. The development of the telephone in Portugal was not so spectacular as of recent years, but provided no unforeseen circumstances intervened they could look forward to steady growth with every confidence. During 1935 £164,000 was spent in improvements and additions. There were now 1,600 call offices in service. Extensions to the Trinidade and Norte automatic exchanges were under consideration, and they had recently purchased a building in the Estrella district of Lisbon where they proposed to install a new exchange. If their present estimates of further growth were realised they expected that additional capital expenditure over the next five years might amount to £800,000.

Ericsson Telephones, Ltd.—Presiding at the annual meeting on April 2nd Col. Sir Harold A. Wernher (chairman) said that the company's manufacturing plant was in full operation throughout the past year, heavy pressure being placed upon it during the second half of the year, with the result that they achieved a record output. They had well maintained their position in the many fields in which they were engaged, and every department had shown improved results. One outstanding example was their totalisator section, and they had installed many such equipments both in this country and abroad. On the telephone side the increase in demand for their materials had also been very substantial. Business from abroad had shown a welcome improvement and their shipments had been heavy. Their overseas business and that with customers other than the Government had increased by 55 per cent. during the year, which followed an increase of 57 per cent. in the previous year. The number of telephones connected to the public system in London was rapidly approaching the million mark, while for the whole country it now exceeded 2,500,000. The rate of expansion was steady and healthy, the figure for 1935 being nearly double that of the previous year.

The Pressed Steel Co., Ltd.—The lists were opened on Tuesday last for an offer for sale of 1,980,000 ordinary shares of 5s. each at 22s. 6d. per share in the Pressed Steel Co. The company was incorporated in 1926 under the name of the Pressed Steel Co. of Great Britain, Ltd., and adopted its present title in August last. Although motor car bodies and pressings constitute the bulk of the output, the company also manufactures "Prestcold" electric refrigerators for both domestic and commercial uses.

Oliver Pell Control, Ltd.—Meetings of shareholders have been called for April 21st to consider the reduction of the capital from £125,000 to £106,396 by reducing the 74,416 issued £1 ordinary shares to 15s. A number of arrangements are proposed, and it is intended to increase the capital to £130,000. The dividend on the 8 per cent. cumulative preference shares is to be reduced to 6 per cent. and the shares are to participate in the profits remaining after the payment of 8 per cent. on the ordinary shares.

The Marconi International Marine Communication Co., Ltd., reports a profit for 1935 of £90,118, as compared with £120,891 in the preceding year, the latter figure including a profit of £30,127 on sale of investments, against only £5,804 in the year under review. The final dividend is 5 per cent., making 7½ per cent. for the year (same), and £13,914 is carried forward (against £13,250 brought in). Meeting: April 17th.

Newman Industries, Ltd.—Particulars of this company were published on Monday last for information only. The company was formed on April 3rd to acquire as a going concern Newman, Sons & Co., electrical and mechanical engineers and manufacturers. It is capitalised at £90,000. The assets to be acquired include the freehold works at Yate, Bristol.

Erinoid, Ltd., in its interim report, states that the profit for the half-year to January 31st was £17,413, as compared with £15,114 for the corresponding period of the previous year. Business continues to be promising and the directors look forward to a satisfactory year.

The Ever Ready Trust Co., Ltd., in a preliminary statement reports that the net revenue for the year ended March 31st last was £26,102, as compared with £25,100. It is proposed to pay final dividends of 4 per cent. on the ordinary stock and deferred shares, making 7 per cent. for the year (same).

The Carrier Engineering Co., Ltd.—Particulars of this company were published on April 2nd for information only. It has an authorised capital of £140,000, of which £125,000 has been issued and fully paid. The company is engaged in the supply of air-conditioning and ancillary plant.

The St. Austell and District Electric Lighting and Power Co., Ltd., proposes to issue a free bonus to all ordinary shareholders of one fully-paid £1 ordinary share for every five held.

Stocks and Shares

Monday Evening.

THE week preceding the Easter holiday is one which never provides the Stock Exchange with any considerable volume of business. People are more intent upon making arrangements for holidays than upon ordinary business affairs, although the latter are by no means neglected. During the past few business days there has been a noticeable demand for Callender's Cable shares. Easter traffics on the railways have been anticipated as a bull point, though, with the return of winter weather, enthusiasm for Home Railway stocks was inclined to cool. America is making, for her own stocks, a running which has served to put up prices, and to focus attention upon utility and other such companies that operate in the States and in Canada. The gilt-edged market is very steady. The Central Electricity Board's annual report is regarded as ample justification for the valuation of the stocks on a 4 per cent. basis.

Electricity Supply Shares

The market for electricity supply shares continues uninteresting. Prices remain quietly firm. Electric Supply Corporations improved from 64s. 6d. to 65s. 9d., and Northamptons from 52s. 6d. to 54s. 3d. Clyde Valleys, Scottish Power, North Metropolitans and British Power and Light, all made some progress. The last mentioned are quoted 32s. 3d. exrights to the new shares which were offered to shareholders at 25s. in the proportion of one new share for every five units held. The new shares are being dealt in around 7s. premium. Among foreign supply companies, Perak Hydros are prominent with a 1s. 9d. rise to 25s. 9d. Palestine "A" shares shaded to 52s. and Tokyo "sixes" to 83. East Africans improved further to 33s. 9d.

Cable and Wireless Activity

The Cable and Wireless annual report is due in May. The question of dividend arrears on the preference stock is, therefore, very much to the fore. Speculation is busy regarding the manner in which these will be dealt with. The possibility of a resumption of preference dividend payments in full is freely debated, and is responsible for an all-round improvement in the stocks. The preference stock has risen 2½ to 110, the "A" 2 to 29, and the "B" ½ to 8. The preference dividend has been paid up to March, 1933, and some £2,700,000 of arrears have now accumulated. In 1934, the gross revenue of the holding company amounted to a little over £1,000,000. Some people think that the results for the year recently ended will be good enough to allow arrears to be paid off in cash: others hold it more probable that the arrears will be capitalised in the form of interest-bearing funding certificates. The interesting possibilities of the problem have attracted speculators to the market. While much of the buying has been done on the part of genuine investors, the hand of the professional operator, always ready to have a finger in these stocks, is evidently busy also.

The Marconi-Marine dividend and profits are pretty well what they were expected to be. At 33s. 9d. the shares, like the dividend, are unchanged. Anglo-Portugese Telephones were also unaffected by the company's results.

Electrical Equipment Shares

The market in electrical equipment shares has succeeded, during the past week, in making quite a fair show of strength. A number of stimulating factors are present to divert the attention of investors from the European scene to the more pleasing domestic outlook. The chairmen of the several electrical equipment manufacturing companies which have recently held their annual general meetings, have had, almost without exception, the pleasant task of unfolding a tale of expanding prosperity within the industry. Prominent among these concerns are the Associated Electrical, English Electric, British Insulated and Enfield Cable companies.

Other important dividend announcements are due to be made shortly and are the subject of optimistic anticipation. The Callender's Cable and General Electric Companies are cases in point. The market has been receiving additional support in the form of repurchases by those who had sold shares in the belief that the German response to the Locarno Powers' proposals would be less conciliatory than it eventually turned out to be.

Changes in Prices

English Electric issues have become the focus of lively interest and discussion since the announcement of the company's strong recovery in profits opened up the prospect of an early resumption of dividend payments. The ordinary shares, at 21s., and the preference, at 25s. 6d., are both 1s. higher on the week. Subscription-lists for the company's new 4 per cent. debenture stock, offered at a price of 98, were open for five minutes only, the issue being over-subscribed. Associated Electricals went further ahead after the annual meeting, the ordinary shares rising 1s. 6d. to 48s., and the preference 6d. to 39s. Buyers were attracted by the news that the company had more orders on its books during the first quarter of the current year than in the corresponding period of last year. The adequacy of the company's reserves against depreciation also received favourable attention.

General Electrics are being bought in anticipation of the approaching dividend announcement. The shares have advanced from 78s. to 79s. 6d. British Insulated are inclined to be reactionary at 5½, but other cable companies' shares are steady. Callender's dividend is due to be announced very soon. The official quotation for the shares is unchanged at 4½, but a seller might reasonably expect to get 2s. a share above that figure in the market. Ericssons and British Aluminiums have not responded to the confident tone of the annual meetings. Chloride Electrical Storage issues are a good market; the "A" and "B" shares have each advanced from 91s. to 93s. 9d. International Automatic Telephones have a better tendency, but Lancashire Dynamos are lower at 41s. 9d. The official quotation for Crompton Parkinsons at 62s. 6d. is no more generous than that for Callender's, mentioned above. Actually, the shares are changing hands at prices between 65s. and 66s.

Miscellaneous Matters

A more optimistic view of European affairs is largely responsible for a general recovery in transatlantic stocks and shares. Telephone and Telegraph stocks are not slow to respond to the brighter atmosphere. American "Tel. and Tel." followed up last week's recovery with a gain of 2 to 167½. International Tel. and Tel. joined in the movement with a rise of ⅜ to 16¾. Western Unions at 91 are as much as 5½ points up, and Radio Corporation put on ¼ to 13¼. Canadian Marconis remain at 8s. 6d. Brazilian issues as a whole show signs of a rally. "Tractions" recovered ¼ to 12¾. Hydro Electrics improved ¼ to 8¼, and International Holdings ¼ to 2 1/16. Among the home traction companies' stocks, British Electric spurted 75 points to 1,600. Tillings also advanced with a gain of 4s. to 70s., ex bonus. Electric and Musical Industries and E. K. Coles are rather better at 27s. 9d. and 24s. 3d. respectively. McMichaels are another 3d. higher at 3s. 6d. Electrolux Corporations staged a good recovery of 1¼ to 25¾.

Share List of Electrical Companies

	Nom.	Dividend. 1933.	Dividend. 1934.	Price April 6.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	77/-	+9d.	3 18 0
City of London	1	7½	7½	37/6	—	4 0 0
Clyde Valley	1	7	8	45/6	+1/-	3 10 4
County of London	1	10½	10½	57/-	—	3 13 8
Edmundson's 7% Pref.	1	7	7	36/-	—	3 17 9
Do. Ord.	1	7	8	45/-	—	3 11 1
Elec. Dis. Yorkshire	1	9	9	47/-	—	3 16 7
Elec. Fn. and Securities	1	12½	12½	3 7/8	—	3 12 9
Elec. Supply Corporation	1	11	11	65/9	+⅛	3 7 0
Lancs Light and Power	1	7½	7½	39/-	—	3 17 0
Lond. Assoc. Electric	1	—	—	34/-	—	4 2 4
London Electric	1	7	8	40/-	—	4 0 0
London Power Deb. Red.	Stock	5	5	107½	—	4 13 0
Metropolitan	1	10	10	52/-	—	3 17 0
Midland Counties	1	7	7½	2	—	3 15 0
Mid. Elec. Power	1	8	8	41/3	—	3 17 7
North Eastern Electric Ordinary	1	6	6	33/6	+6d.	3 11 8
Do. 7% Pref.	1	7	7	34/6	—	4 1 2
Northampton	1	10	10	54/3	+1/0	3 13 9
Notting Hill 6% Pref.	10	6	6	14½	—	4 2 9
North Met. Elec. Ordinary	1	10	10	3	—	3 6 8
Do. do. 6% Pref.	1	6	6	32/-	—	3 15 0
Scottish Power	1	8	8	42/-	+9d.	3 16 2
South London	1	7	7	34/6	—	4 1 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	46/-	—	3 9 7
Public Boards.						
Central Electricity, 1950–70	Stock	5	5	116½	—	4 4 10
Do. 1955–75	„	5	5	119	—	4 4 0
Do. 1951–73	„	4½	4½	112	—	4 0 4
Do. 1963–93	„	—	3½	103	—	3 8 0
London Elec. Trans. Gtd.	„	—	2½	97	+½	2 11 7
London & Home Counties, 1955–75	„	4½	4½	112	—	4 0 4
London Passenger Transport, A...	„	—	4½	124½	—	3 12 4
Do. do. B...	„	—	5	127	—	3 18 9
Do. do. C...	„	3½	4	105	—	3 16 2
West Midlands Joint Elec. 1948–68	„	—	5	116½	—	4 5 10
Telegraph and Telephone.						
American Tel. & Tel.	$100	9	9	167½	+2	5 7 6
Anglo-Am. Tel. Pref.	Stock	6	6	123½	—	4 17 2
Do. Def.	„	1½	1½	29	—	5 3 5
Cable & Wireless 5½% Pref.	„	2¾	4½	110	+2½	3 15 0
Do. A. 7½% Ord.	„	Nil	Nil	29	+2	—
Do. B. Ord.	„	Nil	Nil	8	+½	—
Globe Tel. & Tel. Ord.	10	2½	3½*	16	—	2 3 9
Do. do. Pref.	10	6	6	14	—	4 4 3
Great Northern Tel.	10	20	20	44	+1	4 11 0
Marconi-Marine	1	10	7½	33/9	—	4 9 0
Oriental Telephone Ord.	1	12	12	3½	—	3 13 10
Home and Foreign Trams, etc.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	9d.	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	1600	+75	—
Do. do. Pref. Ord.	„	8	8	179½	—	4 19 2
Brazil Traction	100	—	—	12¾	+¼	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	100½	—	4 19 6
Mexican Light Common	100	Nil	Nil	4½	—	—
Do. 7% Pref.	100	7	7	6½	—	—
Do. 1st Bonds	$500	5	5	57½	—	—
Victoria Falls Ord.	1	20	20	77/6	+2/-	—
West Riding	1	5	6½	52/6	—	2 9 6
Manufacturing Companies.						
Aron Electricity Ord.	1	10	15	66/3	—	4 10 7
Assoc. Elec. Ord.	1	6	8	48/-	+1/6	3 6 8
Do. Pref.	1	8	8	39/-	+6d.	4 2 1
Babcock & Wilcox	1	6	8	55/-	+3d.	2 18 2
British Aluminium Ord.	1	5	7½	41/6	—	3 12 4
British Insulated Ord.	1	15	20	5½	-⅛	3 18 1
Brush Ord.	Stock	Nil	Nil	42½	—	—
Callender's	1	15	15	4½	—	3 12 9
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord.	5/-	—	12½	62/6	--	1 0 0
Do. 8% Pref.	1	8	8	38/9	—	4 2 7
Edison Swan 1st Pref.	1	7½	7½	30/-	—	5 0 0
Electric Construction	1	Nil	3½	1½	—	2 0 0
Enfield Cable Ord.	1	25	25	5	—	5 0 0
English Electric	1	Nil	Nil	21/-	+1/-	—
Do. do. Pref.	1	Nil	Nil	25/6	+1/-	—
Ericsson Tel.	5/-	24	20*	2 3/4	—	2 5 8
Ever Ready	5/-	35	35	24/3	—	7 4 4
Ferranti Pref.	1	7	7	26/9	—	5 4 8
G.E.C. Pref.	1	6½	6½	34/-	—	3 16 6
Do. Ord.	1	8	10	79/6	+1/6	2 10 4
Henleys	1	30	30	7½	—	4 2 9
Do. 4½% Pref.	5	4½	4½	5½	—	3 18 3
India-Rubber Preferred	1	—	5½	1½	—	4 17 9
Johnson & Phillips	1	5	7½	46/9	—	3 4 1
Siemens Ord.	1	6½	4	27/6	—	2 18 2
Telegraph Construction	£1	Nil	Nil	27/6	—	—

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

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19742. "Electrical circuits for the deflection of cathode-ray beams." M. Bowman Manifold. July 4th, 1934. (443952.)
19818. "Tuning-coils for wireless receivers." W. J. Polydoroff and Aladdin Radio Patents, Ltd. July 5th, 1934. (444013.)
22592. "Dynamometric governors." L. F. Braga. August 2nd, 1934. (443894.)
22868. "Electric-discharge devices." M-O Valve Co., Ltd., and G. R. Jessop. August 7th, 1934. (443954.)
22870. "Television." General Electric Co., Ltd., and L. C. Jesty. October 6th, 1934. (Cognate application 7031/35.) (443896.)
23203. "Radio receivers." Ferranti, Ltd., A. Hall and N. H. Searby. August 10th, 1934. (443956.)
25035. "Method of and apparatus for effecting wave-range change-over in high-frequency apparatus." L. L. de Kramolin. May 22nd, 1934. (443900.)
25335. "Dynamo-electric machines." L. Bignon. July 7th, 1934. (443962.)
25714. "Thermionic valves and circuits therefor." C. S. Bull. September 6th, 1934. (443906.)
25777. "Magnetos for multi-cylinder internal-combustion engines." British Thomson-Houston Co., Ltd., W. E. Gough and W. H. Maycock. September 7th, 1934. (443907.)
25778. "Electric motors." British Thomson-Houston Co., Ltd., and A. A. Pollock. September 7th, 1934. (443908.)
25797. "Electric-discharge devices." General Electric Co., Ltd., J. W. Ryde and J. Cates. September 7th, 1934. (Cognate application 18305/35.) (443910.)
25997. "Lanterns for electric lamps." British Thomson-Houston Co., Ltd., E. B. Tuppen and C. W. Wood. September 10th, 1934. (443973.)
26012. "Electrical resistances and methods of manufacturing the same." Marconi's Wireless Telegraph Co., Ltd. September 9th, 1933. (444023.)
26016. "Television and like systems." Telefunken Ges. für Drahtlose Telegraphie. September 9th, 1933. (444065.)
26080. "Commutator windings for dynamo-electric machines." Ceskomoravska-Kolbendanek Co., Ltd., and V. Kauders. September 18th, 1933. (444025.)
26249. "Television." C. O. Browne and Electrical Musical Industries, Ltd. September 12th, 1934. (Addition to 404020.) (444074.)
26277. "Electric circuit-breakers." A. Reyrolle & Co., Ltd., and J. Christie. September 13th, 1934. (444109.)
26301. "Capacity-measuring instrument." L. A. Sharland, Kenwell Radio, Ltd., and Automatic Coil Winder & Electrical Equipment Co., Ltd. September 13th, 1934. (443976.)
26309. "Directional radio receiving apparatus for navigation purposes." Marconi's Wireless Telegraph Co., Ltd., and B. J. Witt. September 13th, 1934. (444111.)
26933. "Electric welding apparatus." British Thomson-Houston Co., Ltd. September 19th, 1933. (444113.)
27013. "Electrical appliances such as coupling-sockets, switches and fuses." J. A. Crabtree. September 20th, 1934. (444114.)
27374. "Cooling devices for metal-vapour electric-discharge apparatus." British Thomson-Houston Co., Ltd. September 23rd, 1933. (444115.)
28573. "Electric-discharge lamps." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). October 5th, 1934. (444119.)
30877. "Electrodes for arc welding." C. Arnold (Lincoln Electric Co.). October 27th, 1934. (443925.)
31288. "Clamps for securing electric transmission line cables to supporting towers." G. R. Shepherd (Westinghouse Electric & Manufacturing Co., Ltd.). October 31st, 1934. (443982.)
31727. "Submersible electric motors." General Electric Co., Ltd., and R. H. Robinson. November 5th, 1934. (444037.)
32951. "Domestic type electrode boilers." L. G. Hill and Hydrelex Electrical Utilities, Ltd. November 16th, 1934. (444125.)
33398. "Methods of and means for extinguishing electric switching arcs." British Thomson-Houston Co., Ltd. November 20th, 1933. (444042.)
34087. "Electric primary cells." C. J. Gordon. November 27th, 1934. (Addition to 423301.) (443983.)
35599. "Means for reducing noise from electric transformers or like apparatus contained in tanks." English Electric Co., Ltd., and A. T. Chadwick. December 11th, 1934. (444129.)
36440. "Electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). December 19th, 1934. (444132.)
36784. "Reflector fittings of electric incandescent lamps." Maxlume Lighting & Heating Co., Ltd., and F. W. Thorpe. December 22nd, 1934. (444083.)
36944. "Electric oscillation generating systems and apparatus therefor." D. M. Johnstone and Baird Television, Ltd. December 24th, 1934. (444133.)

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82. "Manual exchanges for use with teleprinting systems." Siemens & Halske Akt.-Ges. January 31st, 1934. (443986.)
4288. "Switching systems for controlling electric lamps and other current-consuming devices." General Electric Co., Ltd., and N. C. Smart. February 11th, 1935. (444045.)
5312. "Sealing of electric conductors into glass or like materials." A. West & Co., Ltd., and E. Babler. February 19th, 1935. (444138.)
9387. "Electrically driven floor-treating apparatus." Electrolux, Ltd. March 29th, 1934. (443935.)
9593. "Teleprinting installations." Siemens & Halske Akt.-Ges. March 27th, 1934. (443990.)
11767. "Navigation aiding and other directional radio systems." Marconi's Wireless Telegraph Co., Ltd. April 26th, 1934. (443992.)
11789. "Electrically controlled warning signal installations for railway crossings." Deutsche Werke Kiel Akt.-Ges. May 16th, 1934. (444048.)
12616. "Amplitude filter particularly for television." Radio Akt.-Ges. D. S. Loewe. April 28th, 1934. (444049.)
12962. "Thermionic valve amplifiers." C. Lorenz Akt.-Ges. May 2nd, 1934. (Cognate application 12963/35.) (444050.)
17318. "Electric irons." Pres-Toe Flatiron Corporation. June 16th, 1934. (444144.)
18513. "Dynamo-electric machines." M. P. Romeira. June 28th, 1935. (444052.)
19661. "Television systems." Radio Akt.-Ges. D. S. Loewe. December 6th, 1933. (Divided out of 34895/34.) (444149.)
20197. "Television transmitters." Telefunken Ges. für Drahtlose Telegraphie. July 14th, 1934. (444151.)
20280. "Control of paralleled alternating-current electric systems." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges.). July 16th, 1935. (443942.)
21021. "Systems for recording sound-modulated electric currents." Electrical Research Products, Inc. July 28th, 1934. (444053.)
22352. "Induction furnaces." Siemens & Halske Akt.-Ges. August 9th, 1934. (444000.)
23592. "Ionic valves having one or more control grids." Allmänna Svenska Elektriska Aktiebolaget. August 23rd, 1934. (444001.)
25274. "Electro-inductivity heated appliances." O. Neiss. September 11th, 1934. (444003.)
27315. "Electric-heating apparatus for rooms." K. Frowein. October 3rd, 1934. (444055.)
27460. "Directional-radio receiving arrangements particularly for use with ultra-short waves." C. Lorenz Akt.-Ges. October 5th, 1934. (Addition to 405727.) (444005.)
28674. "Magnetos." R. Bosch Akt.-Ges. November 9th, 1934. (443946.)
32603. "Thermionic amplifying systems." Scophony, Ltd., G. Wilkenhauser and J. Sieger. November 25th, 1935. (444058.)
34287. "Anti-vibration fittings for electric lamps and the like." R. J. Hart. December 11th, 1935. (443949.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 1st:—

Impex. No. 566397. All goods in Class 8.—Impex Electrical, Ltd., 26, Bloomsbury Street, W.C.1.

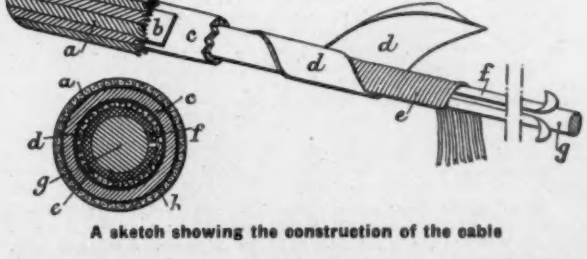
Heatrae. No. 564555. Class 13. Electric immersion heaters.—Heatrae, Ltd., Heatrae Works, St. George's Street, Norwich.

Jendix. No. 565878. Class 13. Electrical mercurial cut-outs.—Safety Fuses, Ltd., 36, Victoria Street, Westminster, S.W.1.

Notex. No. 565902. Class 13. Metal goods.—Notex Electric Co., Ltd., 79, Buckingham Palace Road, Westminster, S.W.1.

Fusible-core Cable for Fire Protection

THE accompanying illustration, from *Le Génie Civil* (Vol. 108, page 190) shows the essential features of the Garrison-L.M.T. "thermostatic" cable developed by the Société le Matériel Téléphonique for the detection of fire. The cable is specially recommended for use in ships because it provides for detection of overheating at any point in its length, and is therefore a convenient means of safeguarding large assembly rooms without a multiplicity of special detector elements. The detective feature of the cable is the core *g* of fusible alloy contained in a split steel tube *f*, round which is the tinned copper strip *d* separated from *f* by the insulating fibres *e*. Rubber insulation *c*, a marker strip *b* and outer braiding *a* complete the construction of the cable. The cable is laid round the most dangerous parts of the space to be protected, and the



A sketch showing the construction of the cable

fire alarm is given at a central point if, owing to the heating of any part of the cable to 140 deg. F., the core *g* melts and comes into contact with the strip *d*. A second circuit gives an "out-of-order" alarm if the continuity of the cable is interrupted, or if there is a fault in the fire-alarm circuit. The temperature of operation of the alarm is fixed definitely by the melting point of *g*, regardless of the rate of heating or the temperature of the surroundings. For special applications, similar cable is made with cores melting at 176, 212 or 266 deg. F.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashby-de-la-Zouch.—Council chamber and public offices; Goddard & Wain, architects, Station Chambers, High Street, Coalville.

Ashford (KENT).—Houses (62); H. Newby, Ltd., builders, Ramsgate.

Ashington.—Child welfare clinic; U.D.C. surveyor.

Banbury.—Hospital (£60,000); C. Burns, architect, Tunbridge Wells.

Beckenham.—Maternity home (£47,140), for the Joint Maternity Home Committee; W. H. Hobday, architect.

Becontree.—Cinema, Lodge Avenue; J. Kay. Underwear factory, Oxlow Lane; Universal Cutting Co., Ltd.

Bedfordshire.—Engineering shops, laboratories, &c., Luton Modern School for Boys, for County E.C.; county surveyor, Bedford.

Birmingham.—Houses (477), Mill Pond estate; Lanchester Housing Trust. Houses, Weoley Castle estate (£46,500); tenements, Henrietta Street; baths, Northfield and Kingstanding; development of Lea Hall housing estate (£1,211,000); fire station, Stud Lane; maternity block, Dudley Road Hospital (£11,623); nurses' home, Yardley Sanatorium (£26,273); and enlargement of Little Bromwich Hospital (£102,000); city engineer. Factory, Cranmore Boulevard, Shirley; Crowder, Ltd., builders, South Road, Birmingham. Central Technical College (£1,000,000), and four schools, Council estates, for E.C.

Blackpool.—Houses (142), Collins Avenue, &c.; R. Fielding & Son. Church, St. George's Avenue; Canon Bamber.

Bo'ness.—Hotel, West Partings; Matt Steele, architect.

Bradford.—Houses (300), Bowling estate, Bradford Road, for Holmes & Co.; G. & J. Vellino, builders, 1, Westland Avenue, Forbs Road, Stockport. Houses (548), Canterbury estate (£172,500); city architect. Transport depôt, Westgate Infirmary site; city engineer.

Brixworth (NORTHAMPTONSHIRE).—Houses (28), White Hills estate; A. Hamson & Son, Ltd.

Bute.—School, Westlands Road, Rothesay (£26,242), for County E.C.

Canterbury.—Civic centre, including two assembly halls and public offices; city surveyor.

Carlisle.—School, Currock, for City E.C.; P. Dalton, city architect and engineer.

Chelmsford.—Swimming baths (£16,000); borough surveyor.

Cheltenham.—School, Gloucester Road (£13,000), for E.C.

Chichester.—Reconstruction of Plaza Cinema; R. Broomhead, general manager.

Chippenham.—Remodelling station (£50,000), for the Great Western Railway Co.; chief engineer, Paddington, London, W.2.

Coatbridge.—Houses, Barrowfield Street and Cliftonhill No. 5 scheme (£91,000); J. Spence, burgh surveyor.

Cowdenbeath (FIFESHIRE).—Houses (112); burgh surveyor.

Cuckfield.—Houses, Bentswood Crescent, Lindfield (£12,525); Thomas White, builders.

Derbyshire.—Schools, Frecheville, Bolsover, Clowne, Duckmanton, Hollingwood and Grassmoor; director of education, Derby.

Devonshire.—Extensions to Royal Counties Institution, Starcross (£65,653), for C.C.

Doncaster.—Elementary school, Warmsworth; Walker & Thompson, architects, Carbon Chambers, Hallgate, Doncaster. Administrative buildings, Municipal aerodrome; R. E. Ford, borough estates surveyor, 3, Priory Place.

Droitwich.—Houses (80), Holloway estate; Robert E. Hulse, borough engineer.

Dudley.—Houses (63), Baptist End estate; borough engineer. Houses (54), Woodside estate (£14,967); Joseph Webb, Coseley. Extensions to factory, Birmingham New Road; Thomas Dudley, Ltd.

Dukinfield.—Jubilee hall (£15,000), electrical work; E. Marshall & Sons, builders, Ashton-under-Lyne.

Dunbar.—Houses (54), Parson's Pool; D. W. Murdoch, burgh surveyor, Town House, Dunbar.

Eastbourne.—Houses (51), Freeman Avenue; Davis Estates, Ltd. Houses (56), Lottbridge Drive, borough engineer.

Edinburgh.—Printing premises, Annandale Street, for the Scottish Newspaper Publishing Co., Ltd.; James S. Johnston, architect, 47, Charlotte Street, Leith.

Essex.—Five hospitals, various districts; county architect.

Ewell (SURREY).—Church, London Road, for the Congregational trustees; secretary.

Galashiels.—Extension to cottage hospital (new heating system); medical superintendent.

Gateshead-on-Tyne.—Houses and flats, Deckham Hall estate, for North-Eastern Housing Association, Ltd.; J. Clark and Son (New Seaham), Ltd., builders, New Seaham. Staff quarters, Whinney House Hospital; borough engineer.

Glasgow.—Extensions to Stoneyetts Institution; city engineer.

Guildford.—Houses (50), Bannisters Farm; Dennis Bros.

Hailsham (SUSSEX).—Cinema, George Street, with flats and shops; John B. Mendham, architect, 18, Victoria Street, Westminster, London, S.W.1.

Hatfield (HERTFORDSHIRE).—Houses (190), Birchwood; R.D.C. surveyor.

Helston (CORNWALL).—Houses (36), Jubilee Terrace; W. J. Crute, borough surveyor.

Hereford.—School, Whitecross; W. Robinson, architect.

Holt (NORFOLK).—Cinema for E. B. Loynes & Son; W. F. Tuthill, architect, Sheringham.

Ilford.—Church, Seven Kings, for the Congregational trustees; P. W. Meredith, architect, 34, Old Queen Street, London, S.W.1.

Jarrow-on-Tyne.—Houses; J. S. Weir, borough engineer and architect.

Lanarkshire.—Houses (5,000), for C.C.; J. Stewart, 36, Albert Street, Motherwell.

Leeds.—Extensions to baths, Cookridge Street (£35,000), for C.C.

Leicester.—Training college and senior school (£57,000), for E.C.

Lerwick.—Houses (180); W. W. Reid, burgh surveyor, Town Hall.

Lewes.—Houses (28); Butler Bros., builders.

Lincolnshire.—Extensions to King Edward VI Grammar School, Spilsby, for C.C.

Liverpool.—Houses (700), Speke estate; Alfred Booth & Co., builders.

Llandudno.—Houses (33), Vardre Park estate, for Whitley Bros.

Loftus (YORKSHIRE).—Alterations to Co-operative Society premises; C.W.S. architects' department, 90, Westmorland Road, Newcastle-on-Tyne.

London.—(ADELPHI, W.C.2).—Modern building, between Adelphi and the Strand, Adelphi estate (£600,000); Collcutt & Hamp, 126, Wigmore St., W.1. (SOUTHWARK).—Health centre, Walworth Road (£36,167); for Borough Council. Tenements, King and Queen Street area (£110,000); L.C.C. architect. (STEPNEY).—Municipal offices, Commercial Road, and tenements, Branch Road (£76,000); borough engineer. (W.C.2).—Extension to tobacco factory, for Lambert & Butler, Ltd., 141, Drury Lane, W.C.2. (CATFORD).—Houses (83), Verdant Lane; Wates (Streatham), Ltd.

Luton.—Aircraft factory, for the Percival Aircraft Co.

Mansfield.—School, Ravensdale area, for E.C. Extension to technical college (£30,000); county architect.

Newbiggin (NORTHUMBERLAND).—Houses (100); U.D.C. surveyor. Premises for the Newbiggin Co-operative Society; C.W.S. Building Dept., West Blandford Street, Newcastle-on-Tyne.

Newcastle-on-Tyne.—Houses (47), Daisy Hill estate, for C.C.; G. Bailey, Ltd., builders, King Street, South Shields. News cinema, Pilgrim Street, for Dixon Scott; Dixon & Bell, architects, Pearl Buildings, Newcastle-on-Tyne.

Norfolk.—School, Thorpe St. Andrew, for County E.C.

Northampton.—Houses (38), Delapre estate; A. W. Darby. Houses (32), London Road; T. Wilson & Son, Ltd. Houses (24), near Welford Road; Manor Building Co.

Nuneaton.—Cinema, Abbey Street, for the Union Cinema Co., Ltd.

Plymouth.—Houses (73), Camel's Head estate; St. Aubyn Estates, Ltd. Extensions to mental hospital (£8,838); Pearn Bros., Ltd. Reconstruction of works, Frankfort Lane; Western Morning News Co., Ltd.

Porterfield (RENFREWSHIRE).—Steel foundry, for Babcock & Wilcox, Ltd.

Portsmouth.—School, Court Lane, for City E.C.; John Hunt, Ltd., builders.

Scarborough.—School, Northstead estate, for E.C.; Shepherd & Son, builders, Blue Bridge Lane, York.

Seaton Valley (NORTHUMBERLAND).—Houses (96), Grange estate; H. Wardaugh, builder, 73, Percy Road, Whitley Bay.

Skegness.—Bus station, for the Lincolnshire Road Car Co.

Southall.—Houses, Lady Margaret Road; G. Wimpey & Co., Ltd. Factory for Mono Containers, Ltd., Cumberland Avenue, London, N.W.10.

Southgate.—Houses (36), Websleigh estate; Wates (Streatham), Ltd.

Southsea.—Extensions to Royal Beach Hotel (£25,000), for the Southsea Beach Mansions & Hotel Co., Ltd.; Harold Bassett, secretary, Queen's Hotel.

South Shields.—Houses (52), Marsden Road, &c., for the North-Eastern Investment Trust; F. W. Newby, architect, 37, King Street, South Shields. Branch library, Marsden Road; borough engineer.

Stoke-on-Trent.—Maternity hospital, London Road Institution (£69,169); borough engineer. Elementary schools, Chell, Goldenhill, Meir, Blurton, Stanfields, and Cornhill, for E.C.

Stornoway.—Houses (154); A. N. Tannahill, burgh surveyor.

Sunderland.—Hotel, Pallion, for C. Vaux & Son; G. W. Bell & Son, Lewis Drive, Newcastle-on-Tyne.

Surrey.—Junior school, Coulsdon; county architect.

Tenterden (KENT).—Houses (50); R.D.C. surveyor.

Tottenham.—Extension to works for E. G. Brown & Co., West Road, N.17.

Twickenham.—Cinema, St. Margarets; G. A. MacDonald, 14, John Street, W.C.2. Factory, Sandycombe Road, for J. Griffiths & Sons (Twickenham), Ltd.

West Hartlepool.—School, Rift House estate; borough engineer.

Worsley.—Houses (28), Brentwood estate, Worsley; Palatine Builders & Estates, Ltd., 17, St. Ann's Square, Manchester.

Wrexham.—Cinema for the Odeon Theatres, Ltd. (£30,000); W. F. Humphreys, Ltd., builders.

York.—Houses (159), and flats; Charles J. Minter, city engineer. Houses (38), Nunthorpe Court estate; H. Williamson. Extensions to Nunthorpe Secondary School; Wm. Birch & Sons, Ltd.